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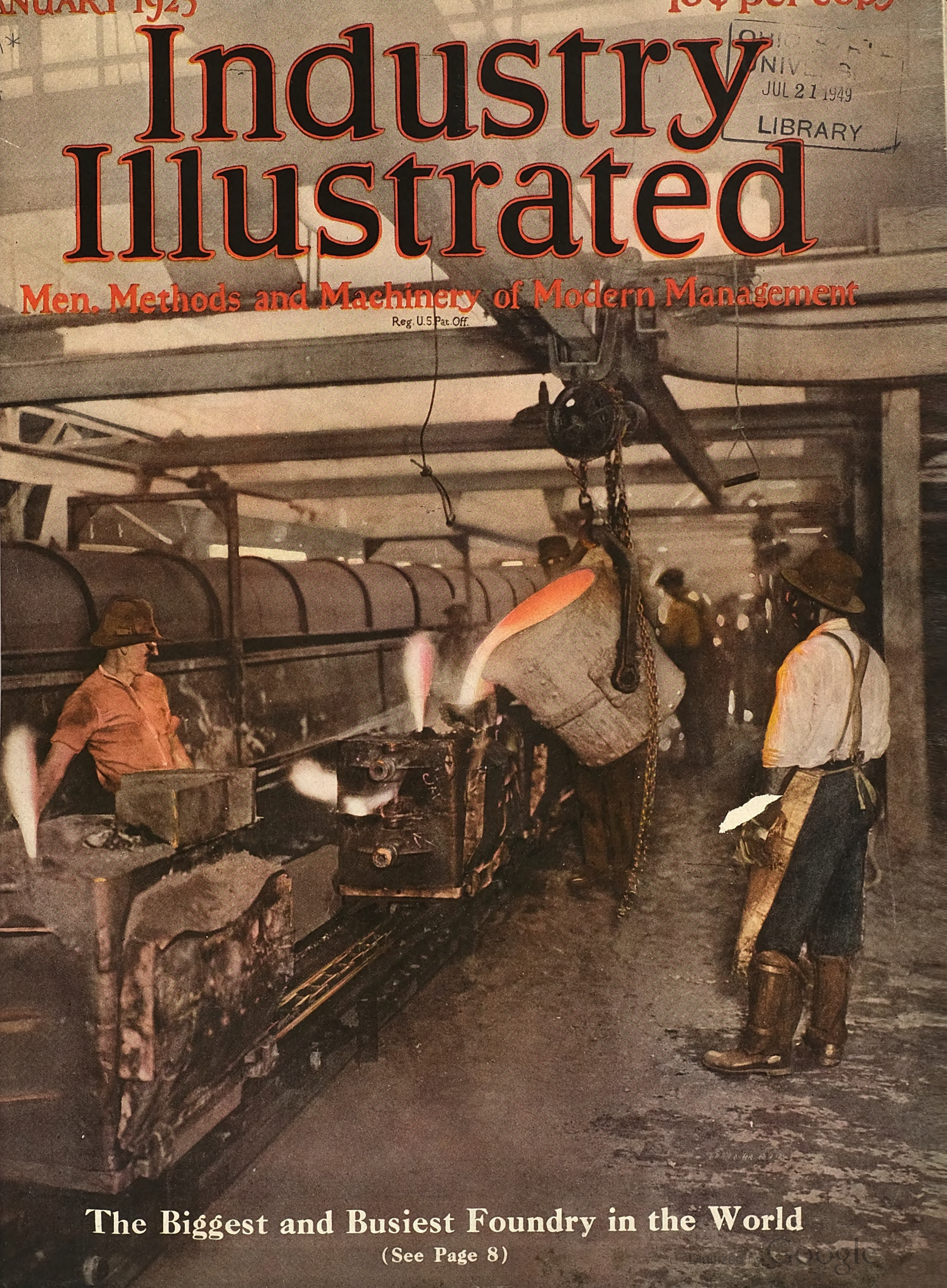
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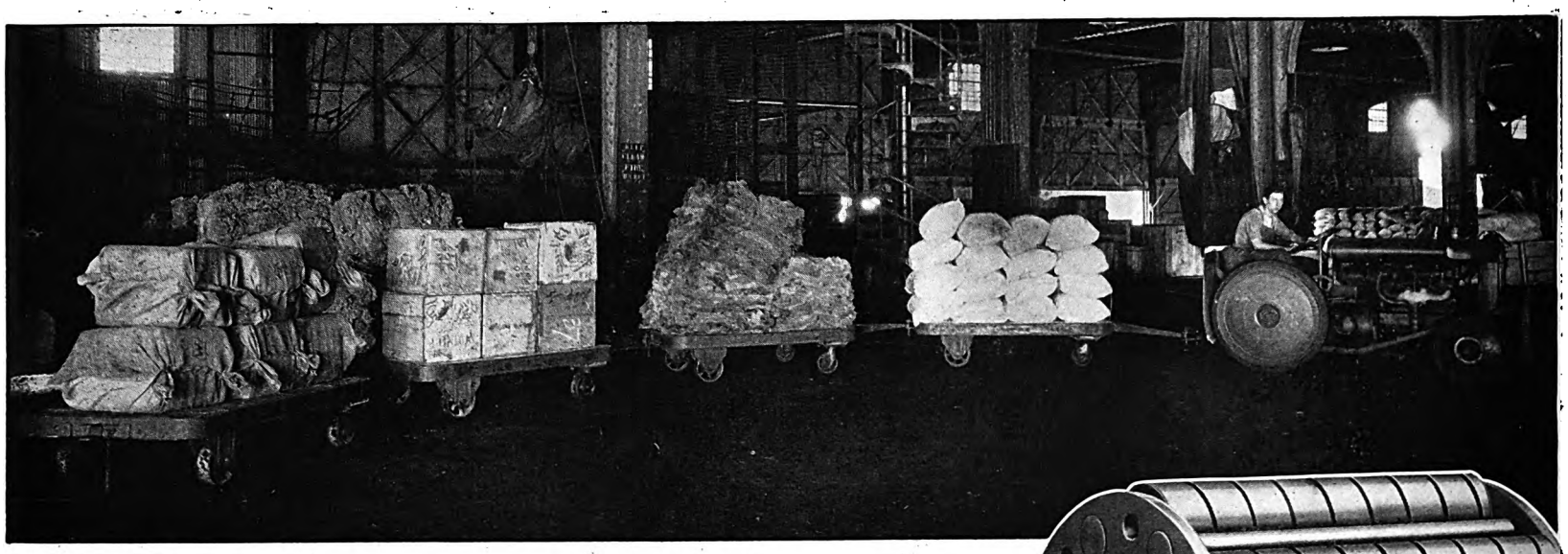
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The Biggest and Busiest Foundry in the World

(See Page 8)

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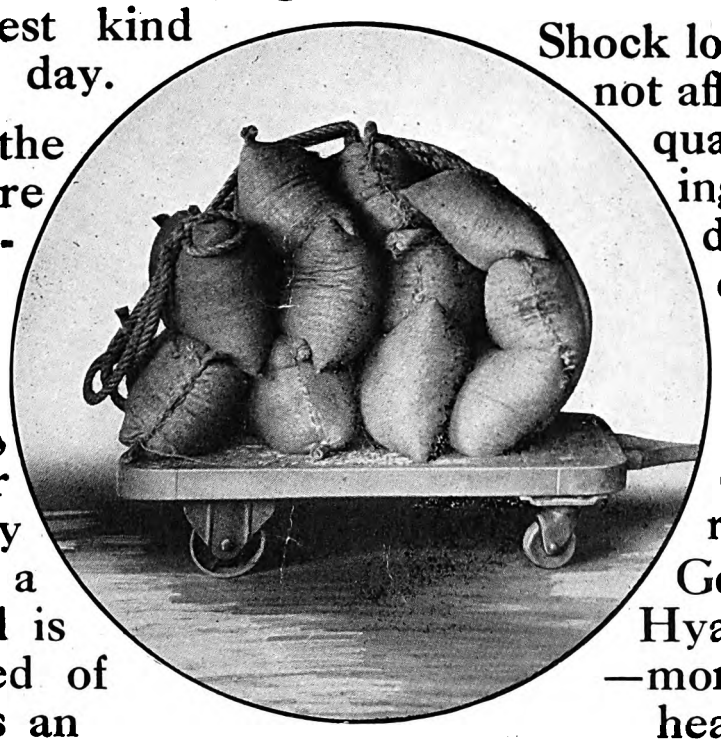


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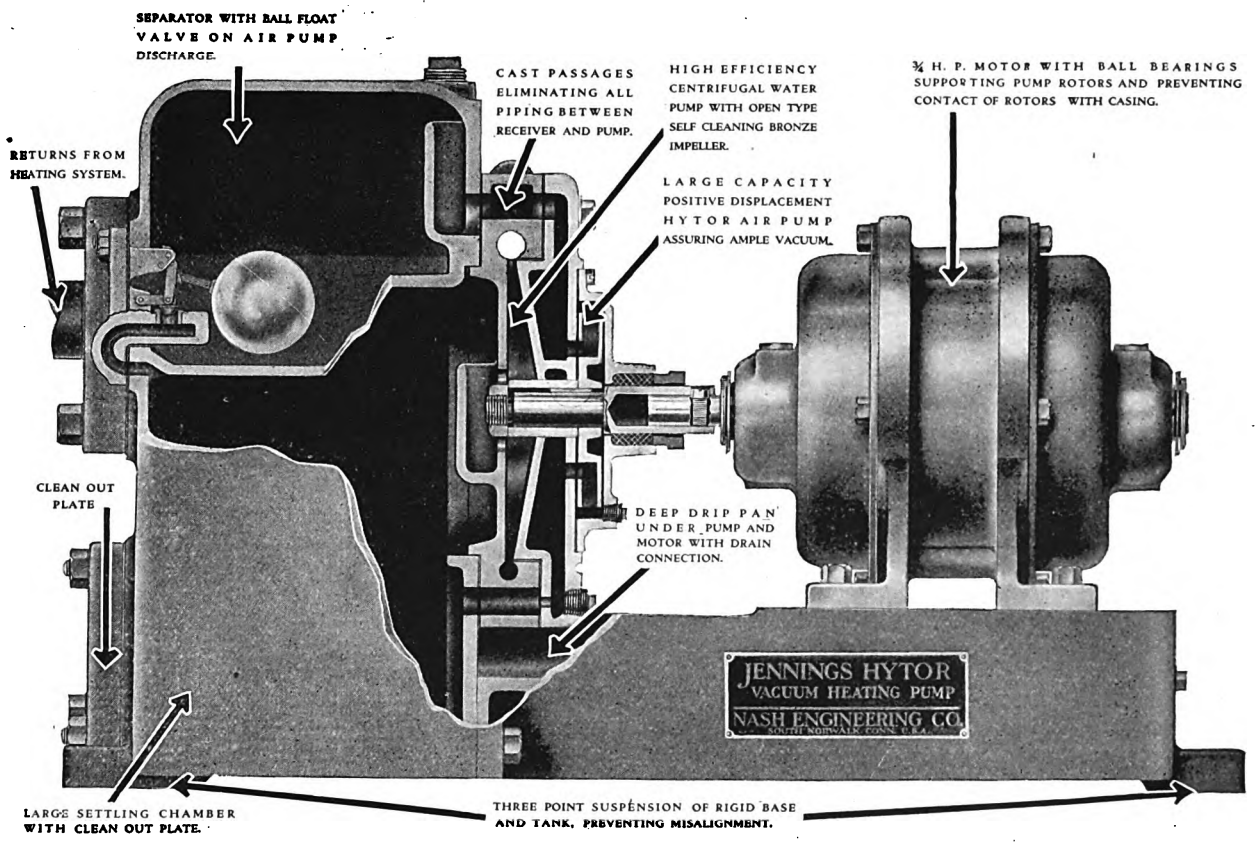
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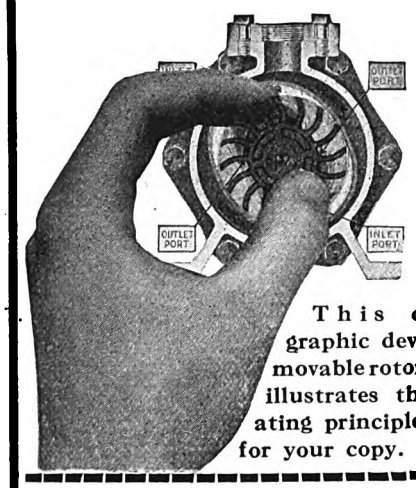
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Industry Illustrated

John H. Van Deventer, Editor

W. Thomson Lees, Associate Adolf Schildkraut, Art Director Reginald Gordon, Associate

EDITORIAL

Men and Machinery

THE history of mankind is known definitely for a period comprising a few thousand years only, and much of what the history of mankind has been during this period is obscure. Some of this obscurity has been removed by the discovery from time to time of historical records and keys to their interpretation, while geology has revealed some information regarding the conditions that prevailed during past ages and monuments of varied nature have endured as visible testimony of the constructive ability of man and his efforts to progress.

To succeed in his struggle for existence, primitive man's first need was for some physical means of supplementing the strength of his body and we may believe that his reasoning mind caused him to carry and use a club as a weapon of defense. Further reasoning convinced man that this tool also could be used to kill and that it supplemented his bodily strength to such an extent that he could not only protect himself against larger animals but he could provide himself with food thereby. Additional thought suggested the spear and the bow and, later, such means of moving heavy masses as the lever, the roller, the wheel and axle.

Man had discovered the supplemental use of tools! His inventive faculty developed. He devised more tools and used them in constructive work. He developed these tools and multiplied their uses until his civilization had become sufficient to enable him to build the pyramids, which have endured to this day and will endure for days to come. His was the influence of mind over matter and all that he accomplished thereby was supplemental to his mind and to his bodily strength.

The result of this development has been that modern man has a multiplicity of machines at his command that operate with greater precision than man himself can operate, that do an amount of work that men in great number could not do manually, and that enable man to manufacture, transport and distribute to the ends of the earth, the products of man's inventive genius for the benefit of other men.

But, all this machinery is at man's *command*. Every piece and part of it is subservient. Of what use would be the most necessary of all of man's machines without some human being to start it, supervise its operation, stop it and maintain its effectiveness? It would be of no use whatever. Hence, no machine can supplant the men who build it and operate it.

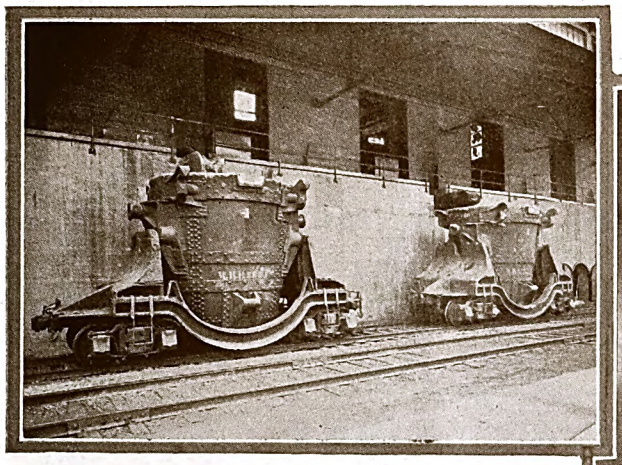
To the shallow minded it may appear that machinery production has superseded manual production but, to those whose thought runs deeper, it is very evident that, now as always, machinery is entirely secondary and deserves only secondary consideration to that of man himself. The way in which to utilize machinery to a maximum extent is to give first consideration to the men who design, build, operate and maintain the machines.

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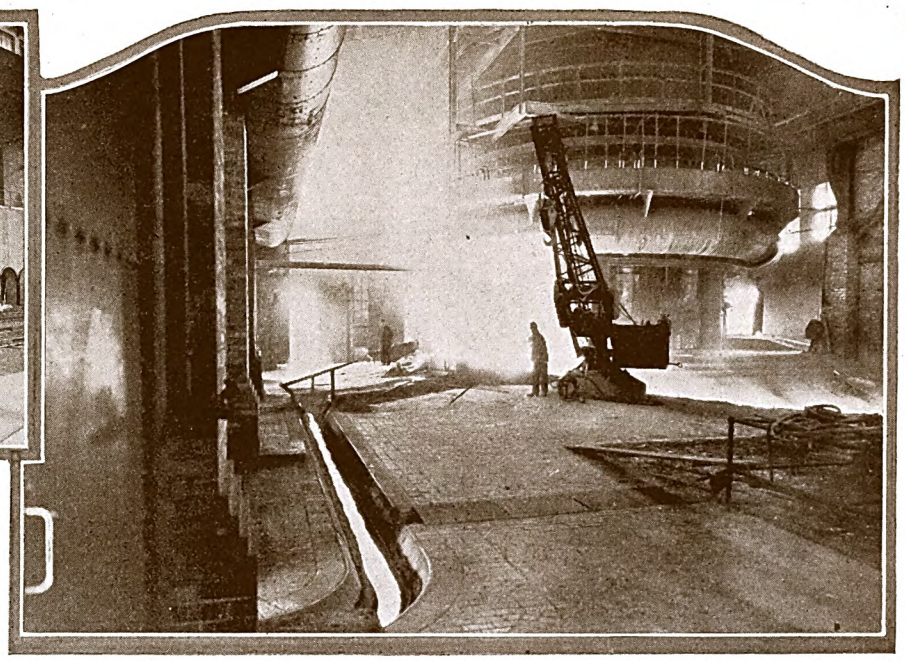
Ford Foundry Practice

Core Making, Molding and Cleaning

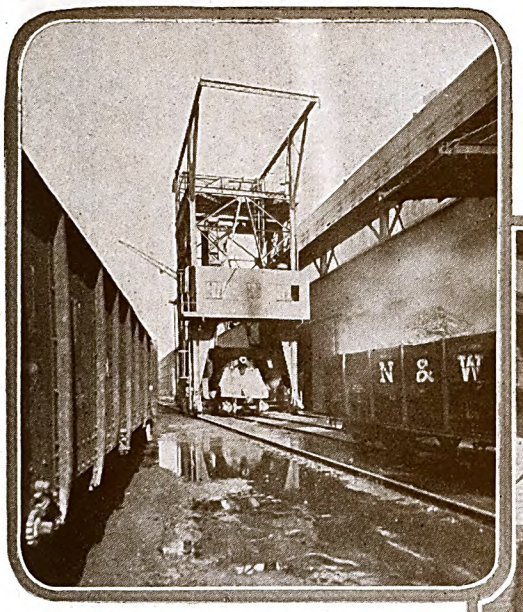
By John H.



2—These huge 80-ton ladles are filled with the molten blast furnace metal. Then they are switched by locomotive to the foundry building.

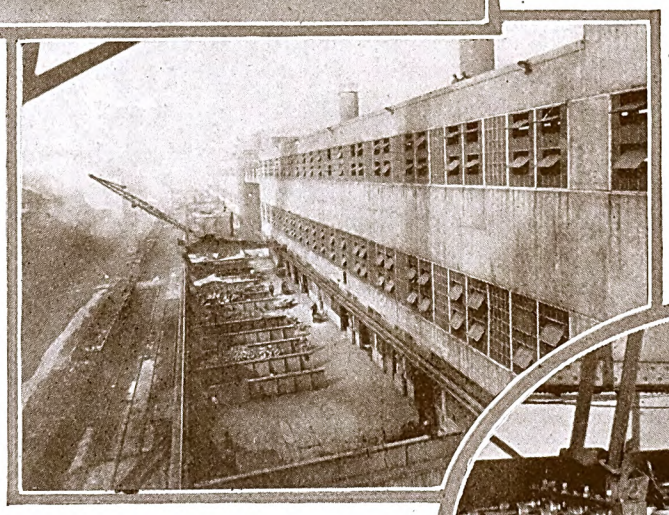


1—This molten stream of metal flowing from the blast furnace is destined to be directly poured, without remelting, into Ford car and tractor castings.

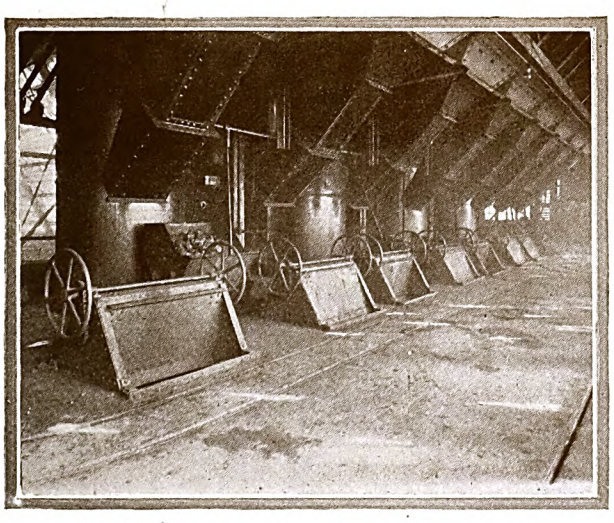


3—Here is one of the 80-ton ladles of molten blast furnace metal "spotted" under a 125-ton Gantry crane at the foundry. This crane pours the blast furnace metal as required into a transfer ladle which serves hot metal containers inside the building.

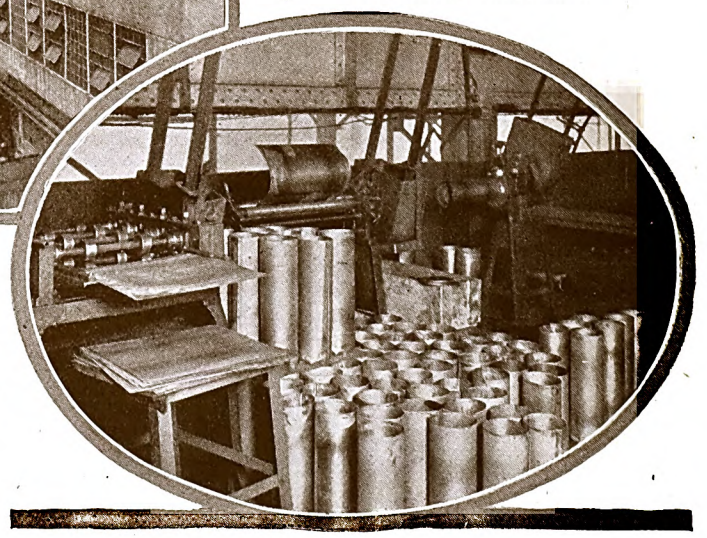
4—The hot metal containers are huge cylindrical tanks lined with fire clay and pivoted on trunnions. By tipping up the rear end of the container the operator in the cage at the right of this picture pours the metal.



5—While most of the pig metal used at the Ford foundry comes direct from the blast furnaces, the twenty-four foundry cupolas are nevertheless kept busy, melting scrap and "back stock." This shows a view of the stock and scrap gallery just outside of the charging floor.



6—There are six batteries of four cupolas running through three mezzanine floors. Limestone and coke come to the foundry on conveyor belt and are stored in the bins shown at the top of this picture.



7—Chips from the machine shop are remelted by baling them in "stove pipes." A special sheet metal working department is located on the charging floor, to make these containers.

THERE is a certain universal fascination to the technical and non-technical man alike, in watching the pouring of molten metal. There is a similar fascination in watching the movements of a smooth-running ingenious machine. The Ford foundry at River Rouge is doubly fascinating to the visitor because, in addition to its being the biggest and busiest foundry in the world, one sees here almost incessant streams of molten iron, aggregating *fifteen hundred tons each twenty-four hours,* and because the entire foundry with its conveyors, molding systems, elevators, and other methods of mechanical transportation, is in real-

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oat River Rouge

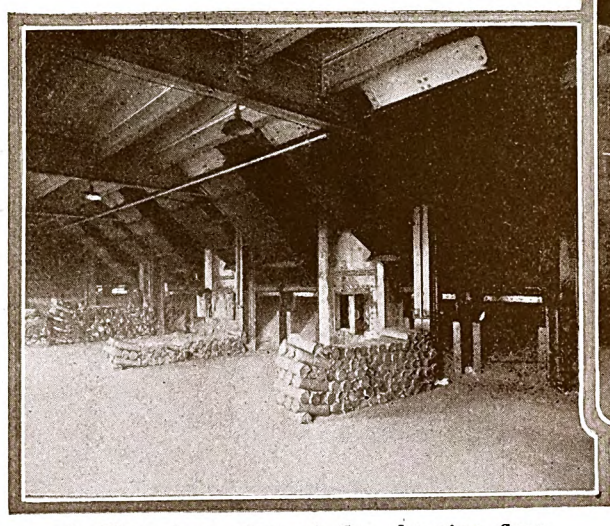
ni Castings "On the Move"

HN VAN DEVENTER

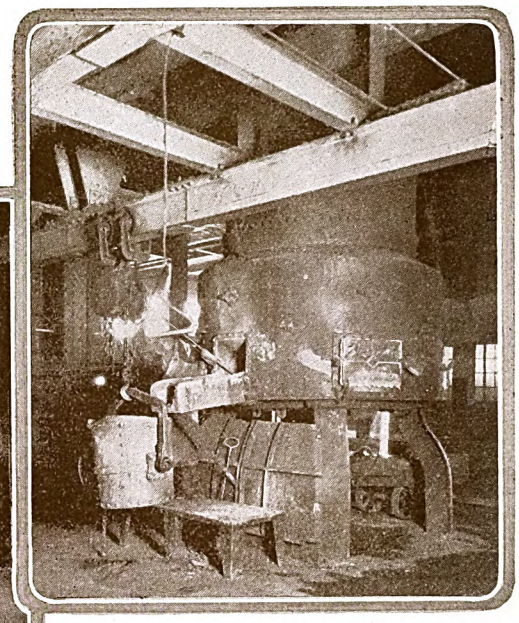
ity one huge, smooth-running, highly ingenious machine.

River Rouge is unlike any foundry that the reader is likely to have visited. Its keynote is *transportation* and *continuous operation,* which two things go together as cause and effect. Men, molding machines, core ovens, tumbling barrels, and ladles of molten metal are welded together through engineering skill into one elaborate mechanism in which the machinery takes the footsteps and the men stand still.

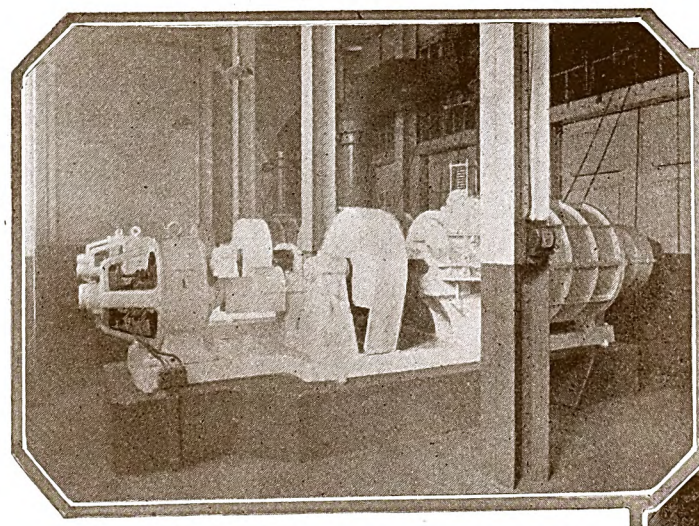
Along the twelve hundred-foot wing which comprises the backbone of the foundry building are situated twenty-four huge cupolas, any one of which would be sufficient to serve the purposes of a foundry of average size. There is no waiting to "pour" in this foundry until three or four o'clock in the afternoon for the molding floors to become filled with molds—for there are no molding floors. The blast is "on" twenty-four hours a day and every two or three minutes one or more of the twenty-four cupolas is spilling its white hot molten metal into one-ton ladles suspended by trolley and chain hoist from monorails above. This picture is the first that is painted upon the observing mind of the visitor to



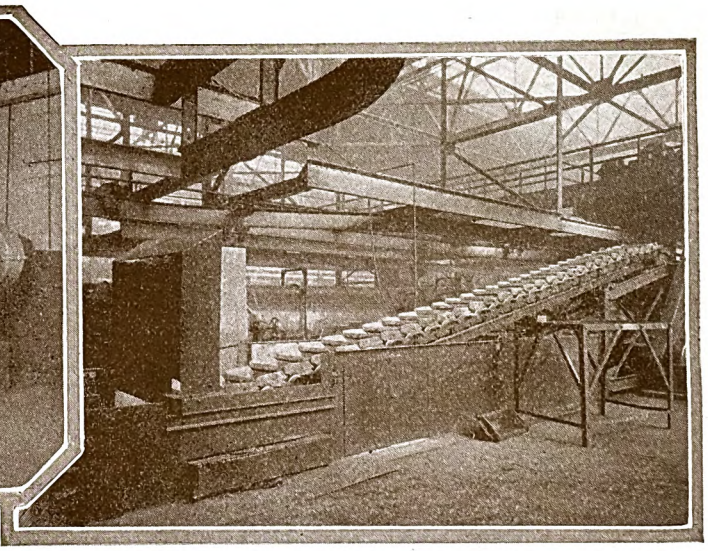
8—Here is a view of the charging floor showing chip containers and also the chutes through which coke, limestone and "back stock" are introduced into the cupola.



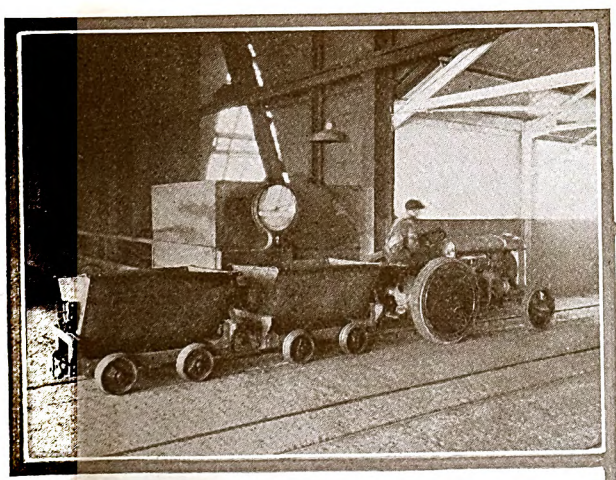
9—View of a cupola on the ground floor level. Twelve-inch monorails carry the one-ton hot metal ladles to the pouring stations along the quarter-mile foundry front.



10—Blast for the cupolas is provided by means of positive pressure blowers housed in six blower rooms.

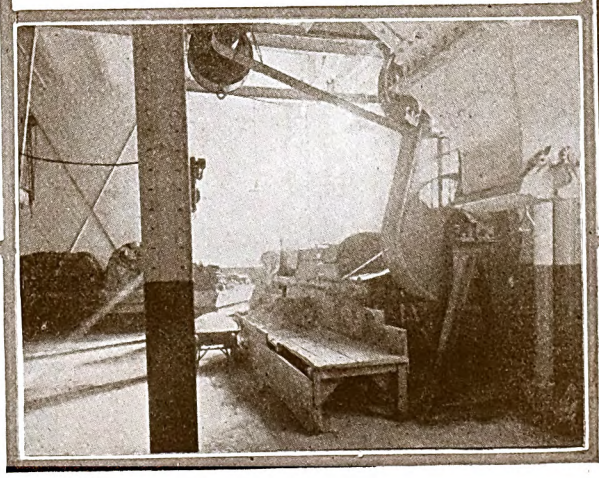


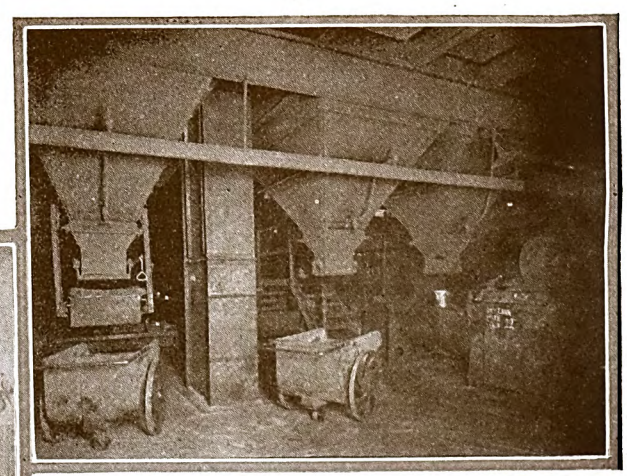
11—Conveyor pig molds are stationed near each cupola battery. In these molds the metal, too cold for pouring into molds, is pigged.



12—Foundry scrap or back stock is transported in tip cars drawn by special Fordson tractors and weighed as shown above.

13—Fire clay for daubing the ladles is mixed in special machines such as shown above, which shows the interior of a ladle daubing room.





14—The making of a Ford cylinder starts with the making of its cores. Core sand prepared in screening and mixing machines is stored in the bins shown above and dropped as required into the core sand wagons.

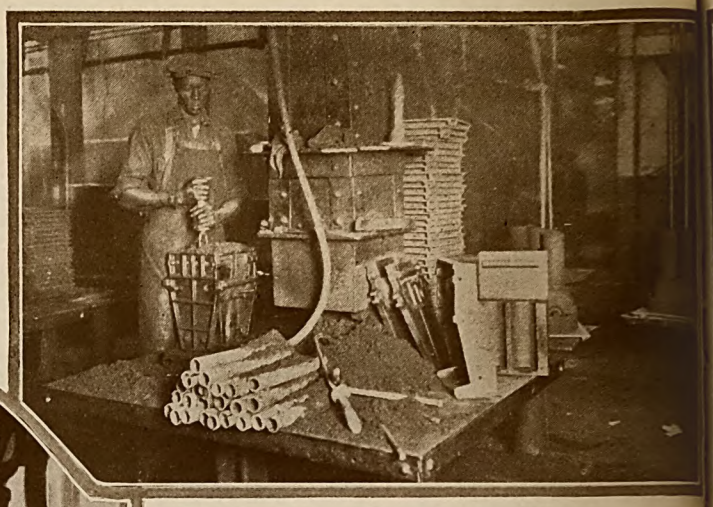
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15—The wagons of core sand are wheeled upon galleries which extend over the core ramming tables and the sand dumped into the opening shown at the left and right of this picture.

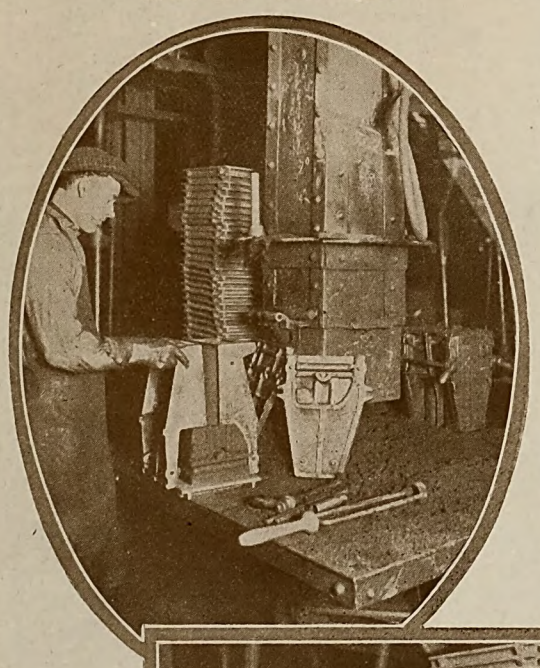


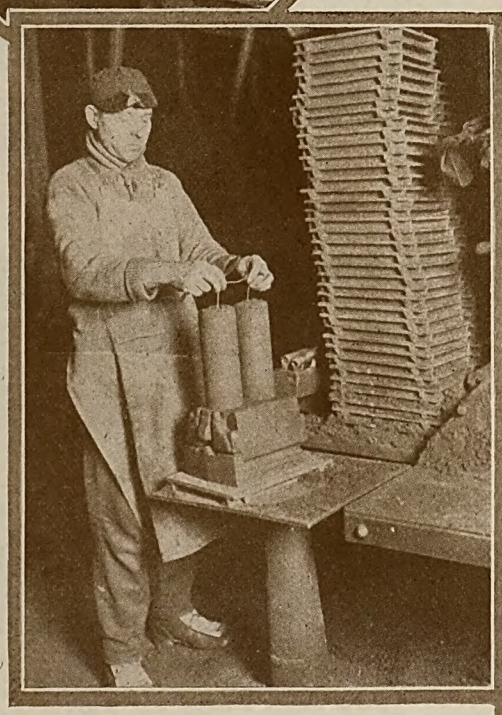
16—From the core sand gallery, spouts lead down to the ramming tables shown at the left. At the right is a pendulum core conveyor for carrying the finished cores to the ovens.



17—This shows the first step in making a typical Ford core, namely the cylinder body core. Notice the four-part metal core box at the right.

18—After the core has been rammed the box is turned upside down and taken apart.





19—Next an expert finisher slicks up the core and places supporting wires.



20—Then the finished green core is lifted and placed upon one of the shelves of the pendulum core conveyor.

the River Rouge foundry, and he wonders first how molds enough can be made to dispose of such an enormous quantity of metal, and next how all of these filled ladles in their journeys from pouring stations to cupolas can be kept out of traffic jams.

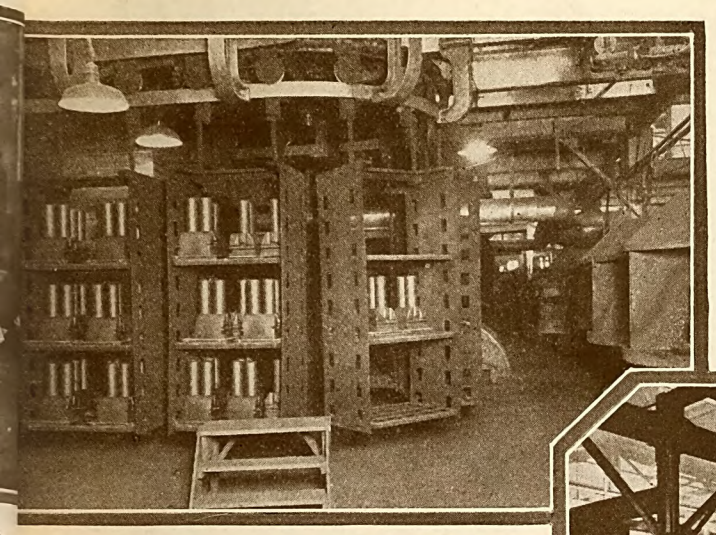
The answer is simple. Everything moves at River Rouge and moves over *predetermined routes* without interference. The ladles of hot metal are skillfully switched to their destinations by means of a double track system of monorails and numerous crossover switches. Just at the very moment one anticipates a collision between two ladles a switch is skillfully thrown and they come to a definite parting of the ways. As for the molds they are arriving on conveyors, so many per minute with almost mathematical precision, all day long at the pouring stations adjacent to the cupolas.

The cupolas at River Rouge, many and large as they are,

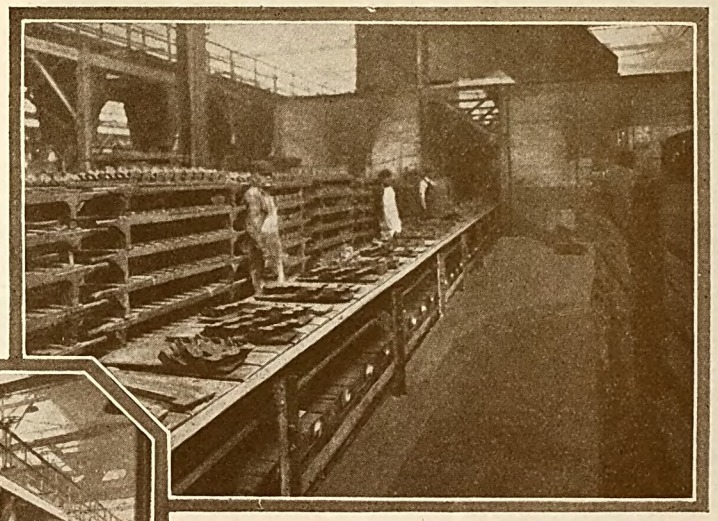
21—The pendulum core conveyor carries the green core to a spray hood where it is sprayed by compressed air with core wash.



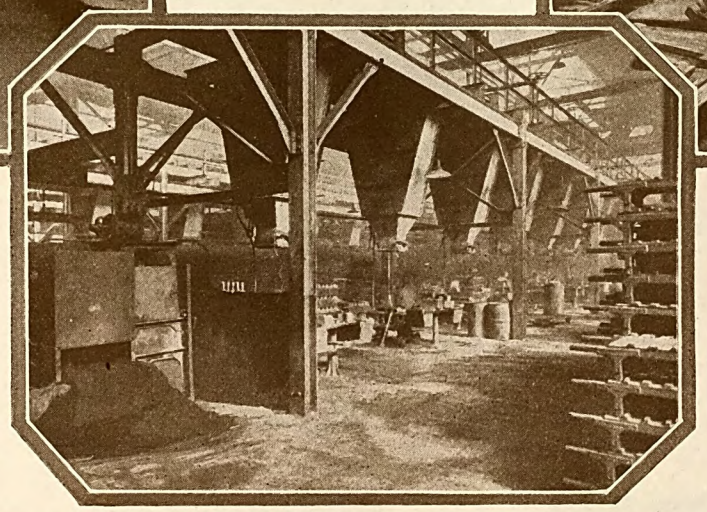
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22—Next it is placed on a shelf of one of the cabinets of the core oven conveyor to be baked during its two-hour journey through the ovens.

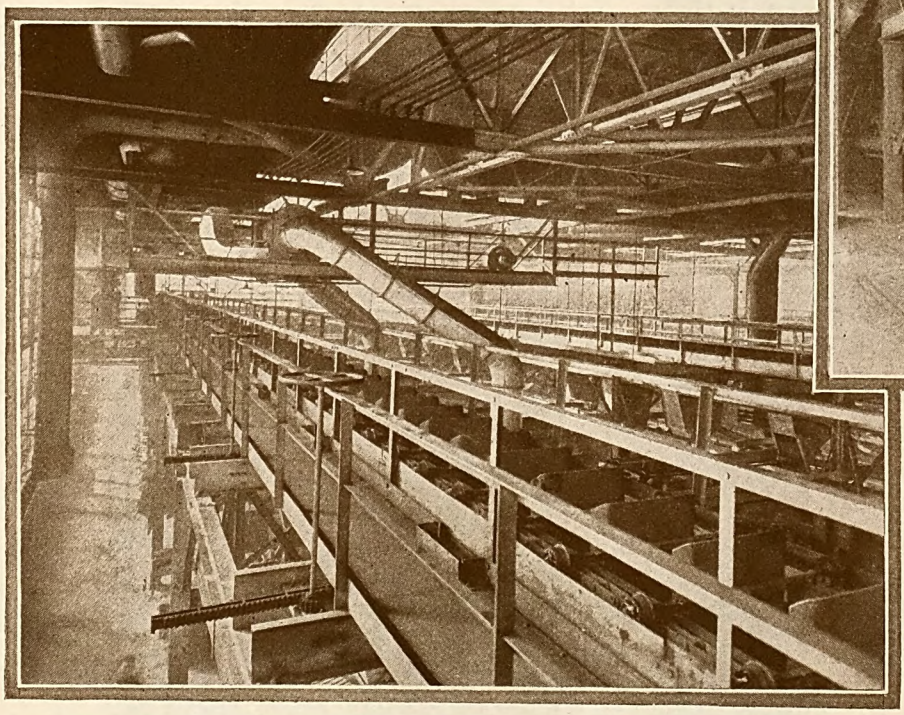


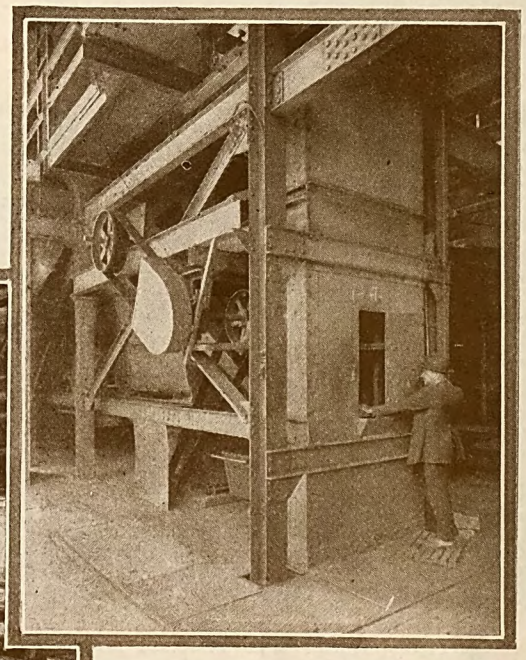
23—Emerging from the ovens the finished cores are placed upon longitudinal conveyors which carry them to storage racks adjacent to the molding systems.



23a—The heavy molding systems are triple lines of floor conveyors 288 feet long. On either side of each system are batteries of molding machines served with sand from overhead galleries.

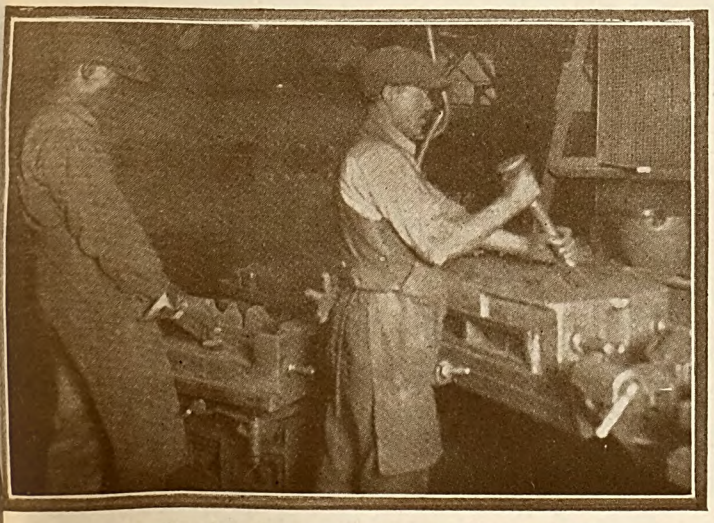
not represent the primary eans of melting the metal for stings. It is in the blast rnaces in an adjoining build-g that the ore coming from e Ford mines is smelted with ke from the Ford coke ovens, id reduced to molten metal at ie rate of a thousand tons ach twenty-four hours. This etal is transported to the undry by means of huge ghty-ton ladles, pulled by comotives and tipped by uge cranes, being finally re-ived in thirty-ton clay lined lting "tea pots," three of ese hot metal containers be-g interspersed with the cu-olas and tipping their fiery ontents into each partially lled ladle of cupola metal. he cupolas in fact are in-nded to take care largely of ie "remelt"—the back stock, crap, sprues, risers, and shop eturns. "Why," asked the ord engineers, "should it be ecessary to let blast furnace etal first cool into pigs and ien go to the expense of melt-g it again?" And so in spite





23b—Before the molding sand goes to the gallery it is put through a screening and cutting machine such as shown above. The greater part of this sand is reclaimed through conveyors below the floor from the flask shakeout stations.

23c—Conveyors carry the reclaimed sand along the sand gallery, depositing it in the bins over the molding machines.

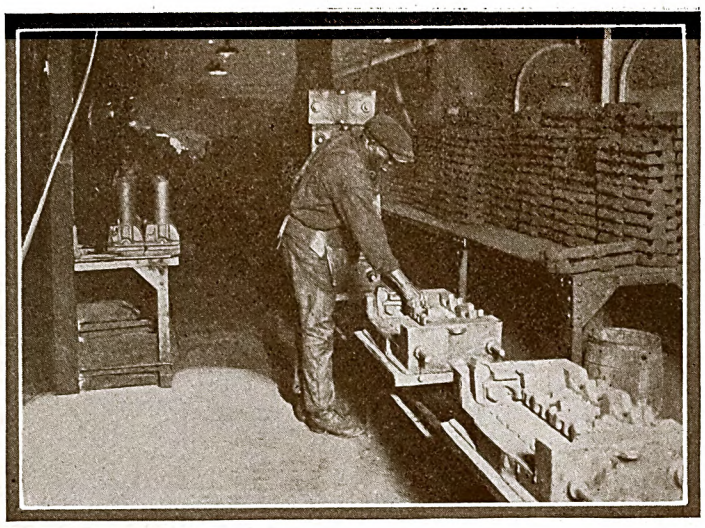


24—Ford cylinder drags are rammed on rollover pattern-draw machines, such as shown above. Then the "drags" or lower halves of the molds are placed upon the conveyor system.

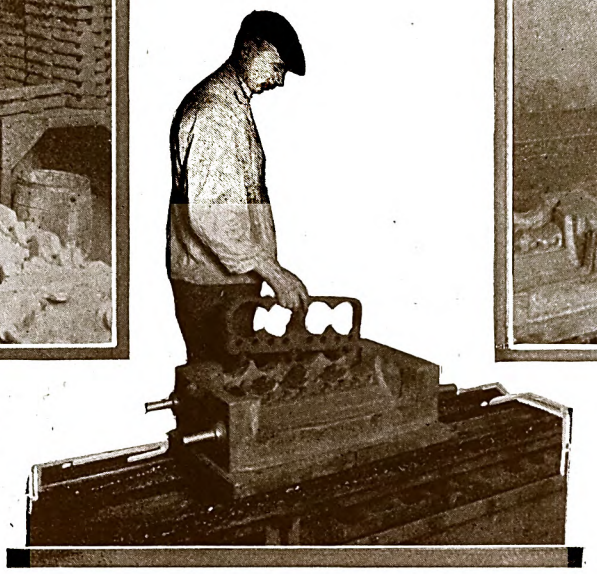


25—As the molds proceed on this journey, they pass various operators who place housing, port, water jacket, gear case and other cores.

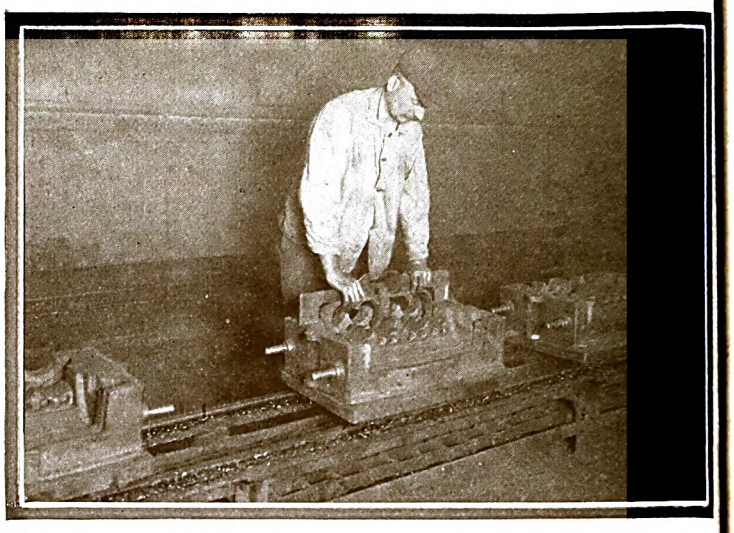
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26—Each operator has a certain duty to perform and does that one thing only, doing it with maximum efficiency.



27—This man for example, is placing the water jacket core in position.



28—And this man is testing the setting of the water jacket core by means of a templet which fits the core.

of precedent and practice, which said that it was impossible to secure light, thin-section, machinable, high-silicon castings without such remelting, the fiat went forth "it must be done." And it *was* and *is* being done! Just how is told in the pictures.

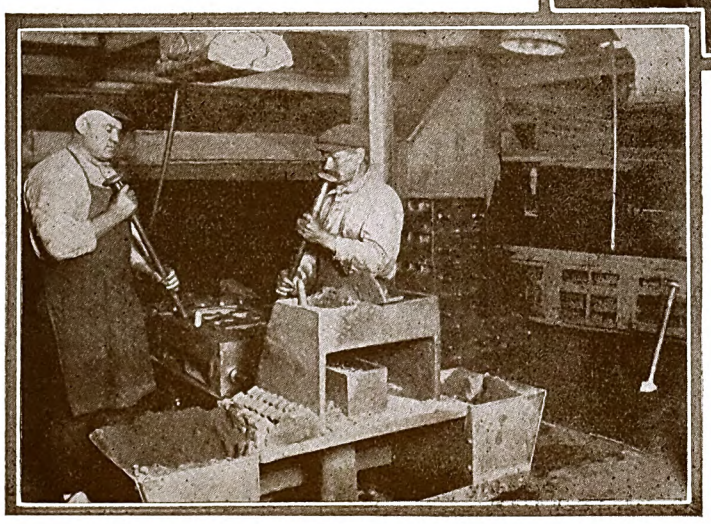
Except for some of the brass and aluminum work and the minor amount of jobbing work which is done at this foundry (for shop repairs), there are no molding floors such as one is accustomed to see in the usual foundry. As far as the wood block floors themselves are concerned, they are as clean as the floors of an average machine shop—not littered inches deep with molding sand. For the sand is personally conducted to its destination—the flask—by means of conveyors and strategically placed delivery spouts, so that it goes where it is intended to go, namely, into the flask instead of upon the floor. But more about this sand transportation later.



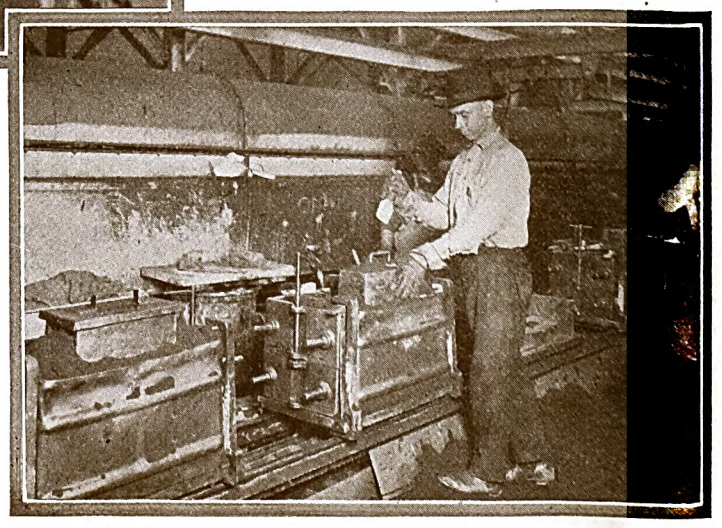
29—Here the cylinder body cores are being placed, two of them to a mold, forming four cylinders.

30—After the cores have all been placed their setting is tested by means of a metal templet as shown below.



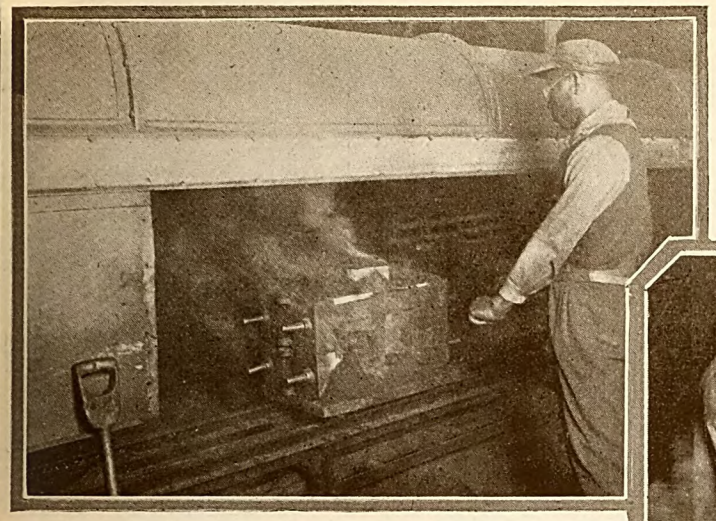


31—The copes, or top halves of the cylinder molds, are rammed on special stripping plate machines.

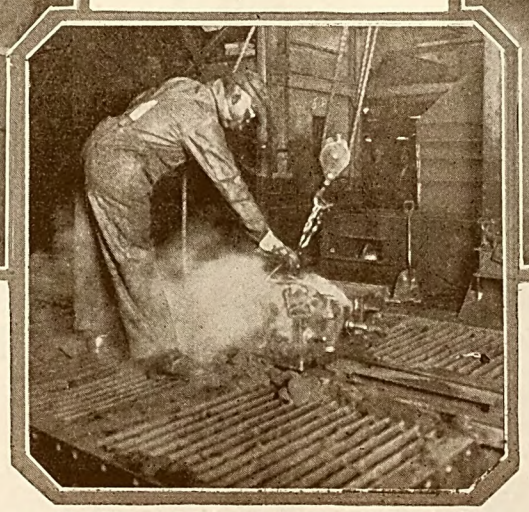


32—After the cope has been placed upon the drag the mold is closed, and all that remains is to ram up the back plate and the runner box through which the metal is to be poured.

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33—By the time that the poured mold has traveled some 200 feet under an exhaust hood on the cooling line it has solidified. As it emerges from the hood an operator knocks off the runner block.

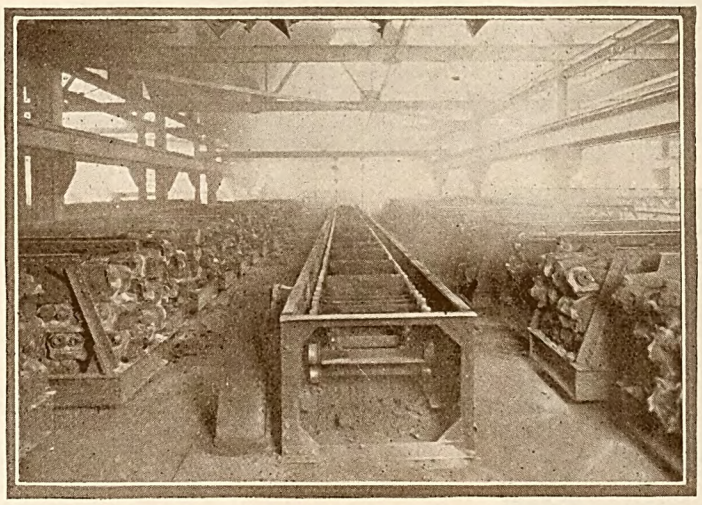


35—The red hot castings are snatched from the drags by means of ice tongs and are swung over to the hot casting conveyors to begin their journey to the cleaning mezzanine.

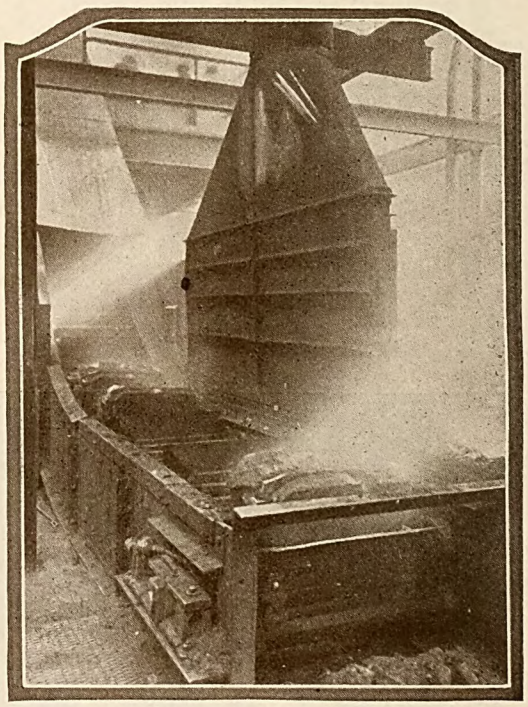


34—At the extreme end of the cooling or return line are the shakeout gratings. As the flasks reach these they are broken open.

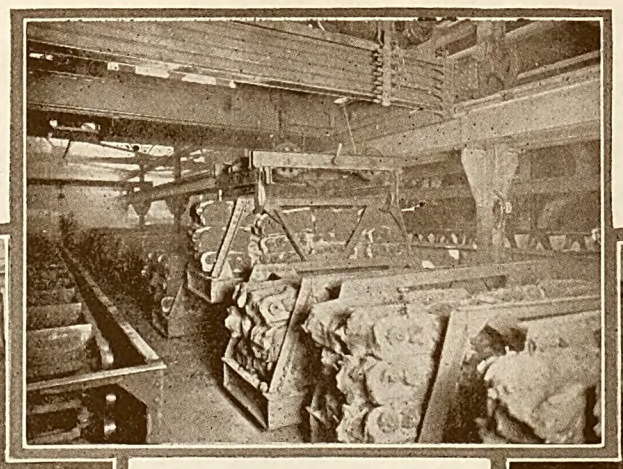
Stretching away into the distance as one looks from the cupola front, are the molding systems or conveyors on which the evolution of the molds takes place. One-half of the space in the foundry devoted to molding is confined to heavy castings, such as cylinder block and tractor transmission frames. As one stands near the cupolas and looks toward the terminus of one of the six heavy casting "systems" he sees—back of the tipping ladles at the pouring station—a three-hundred-foot perspective of men, molding machines and growing molds. On either side of each one of these duplex, or rather triplex, systems, chain drag conveyors facilitate the journey of the ever-growing molds from the first stage in which the drag half of the flask is rammed, to the final stage of the "up" journey at the pouring stations. Between these two active outer lines, both moving in the same direction, is the return line, hidden by a smoke hood under which the liquid cylinders and



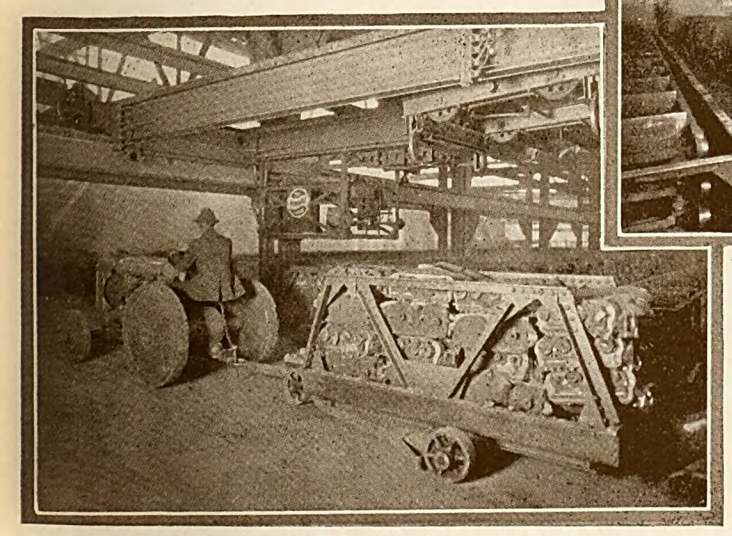
37—On the mezzanine the cylinder castings are swung from the hot casting conveyor into cooling racks and allowed to cool for about four hours.



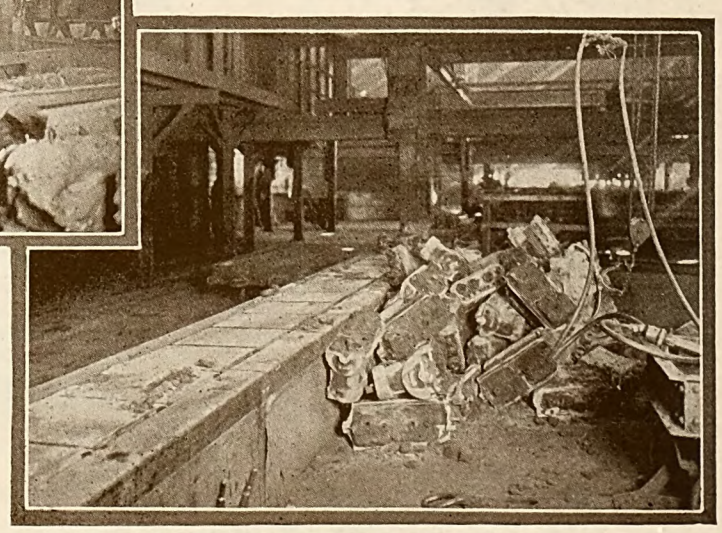
36—This shows the receiving end of one of the hot casting conveyors which terminates on the mezzanine.



38—Then the racks are picked up by crane and carried out to a mezzanine gangway.

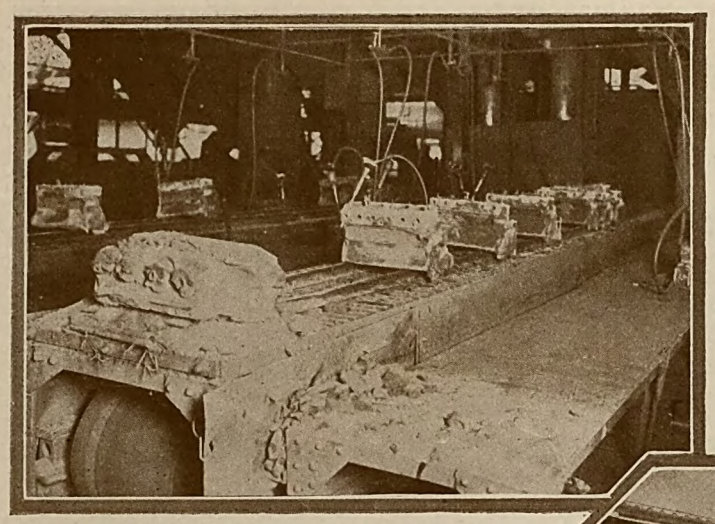


39—Next they are dropped upon lift trucks and drawn by Fordson tractors to the cleaning station.

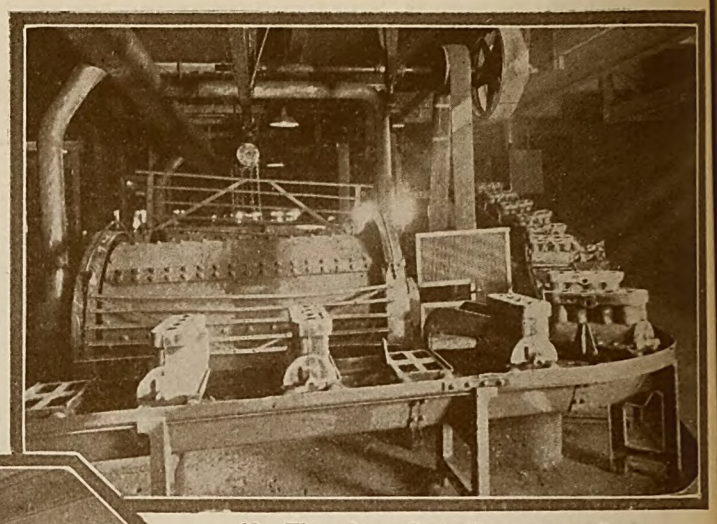


40—At the cleaning station the cylinders are placed upon moving platforms where the rods and vent tubes are removed and the heavy chipping operations are performed.

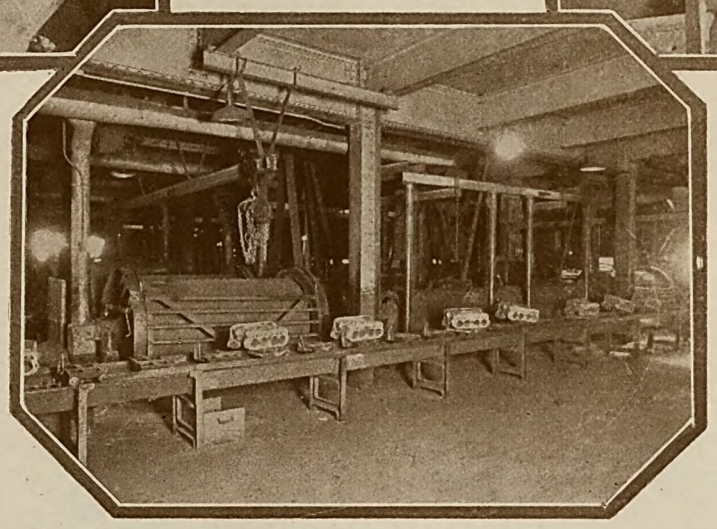
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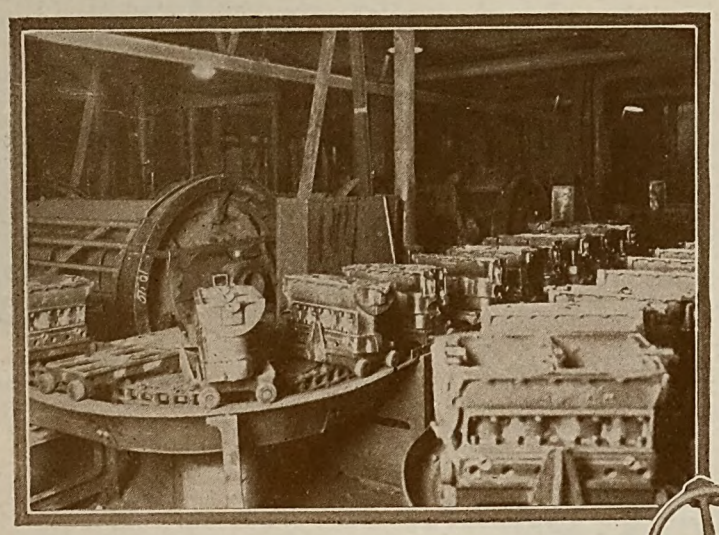
41—Then the core sand is knocked through the gratings shown above to be carried by conveyor to the sand reclaiming machines.



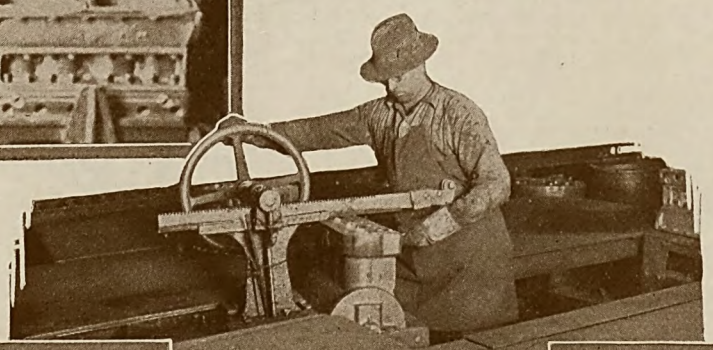
42—The cleaned castings come down from the mezzanine on special cradle conveyors. There are six sets of these conveyors at River Rouge.



43—The conveyors go past batteries of tumbling barrels and feed these barrels as well as carry away the cleaned castings.



44—The conveyors wind in and out among the batteries of tumbling barrels, finally making their exit close to the machining department.



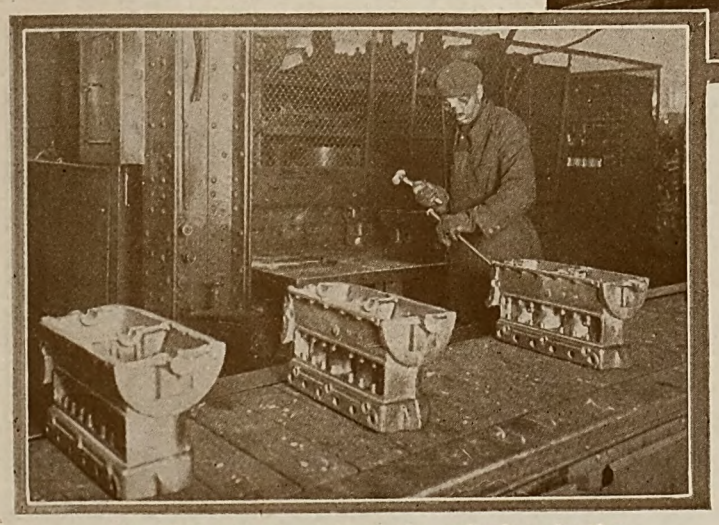
45—At this point the core wires are pulled out through the inlet and exhaust ports by means of a simple yet ingenious rack and pinion mechanism.

frames, imprisoned in sand, make their return journey to the shakeout stations, becoming solidified the while. And more, later, about these journeys.

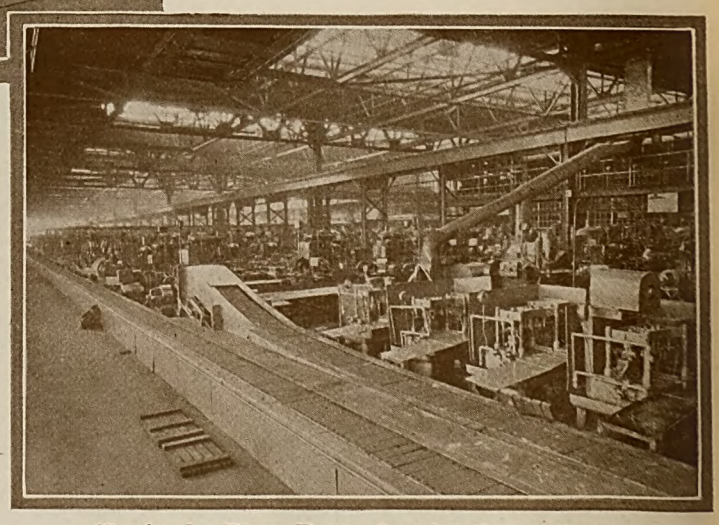
Walking down the length of the foundry along the cupola front and past the heavy molding systems, one sees in the space devoted to the lighter castings what appears to be a veritable forest of "merry-go-rounds." These are the light molding systems, each system consisting of an endless chain of pendulum conveyors, each link presenting a knee-high suspended shelf which is either carrying a fresh mold toward the pouring station or a smoking mold away from it. There are some twenty-one of these "merry-go-rounds" (as they are familiarly called) in operation today, and eight more being installed.

So much for the first general impression of the visitor. It is usually a confused one. The scale on which activities are carried out is so vast that it

(*Continued on Page 28*)



46—The last journey of the cylinders in the foundry is on the flight conveyor shown where the final chipping operations are performed. This conveyor acts as a feeder to the machine shop.



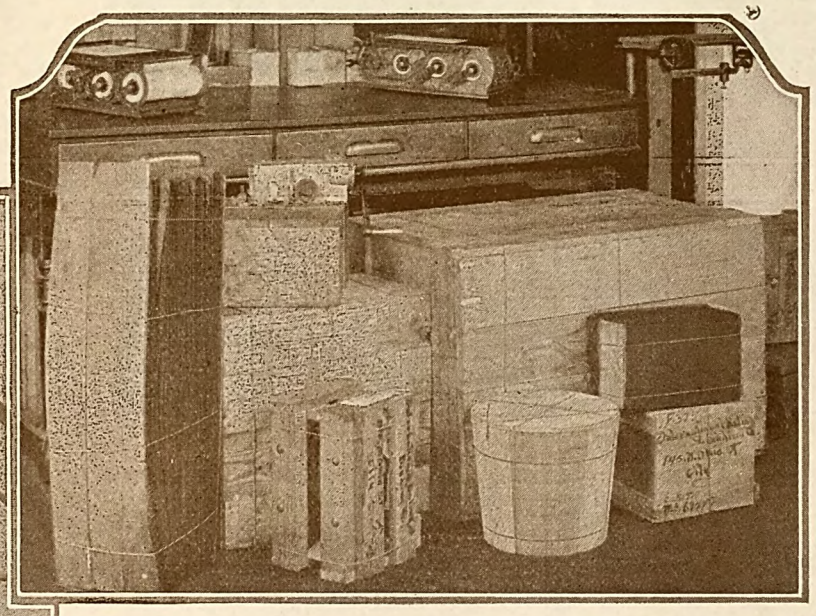
47—At the River Rouge foundry the castings made are machined before they leave the building. This is a view of the enormous machine department with its conveyors for carrying work in process.

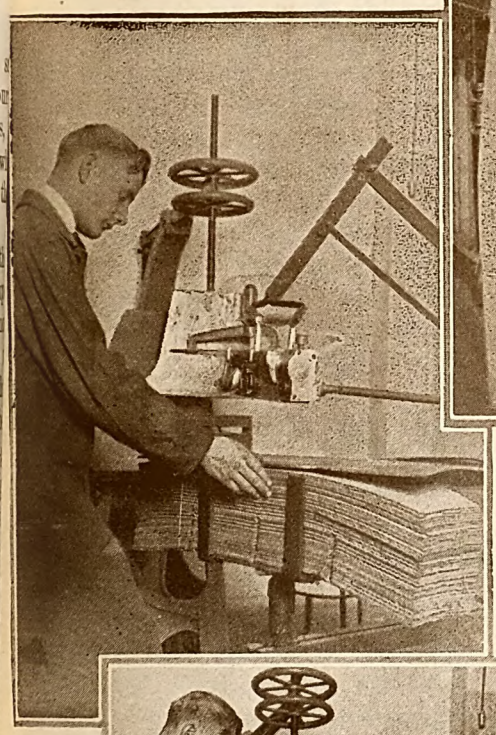
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Better Bundles at Less Cost

A Wire-Tying Machine of Recent Development

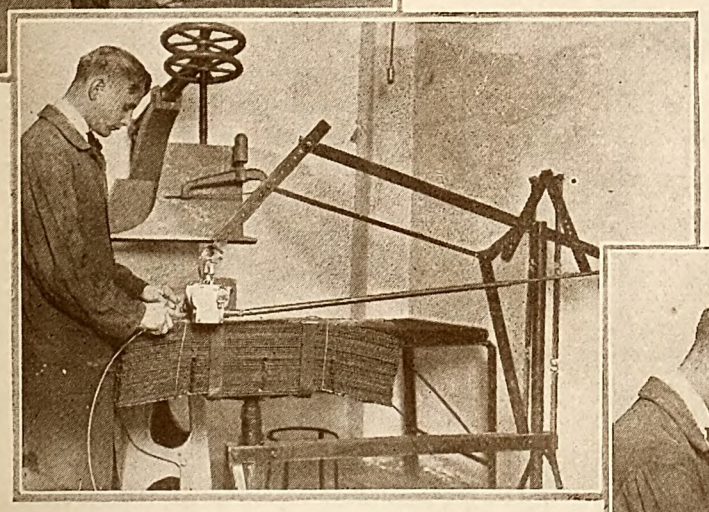
By H. M. Roberts



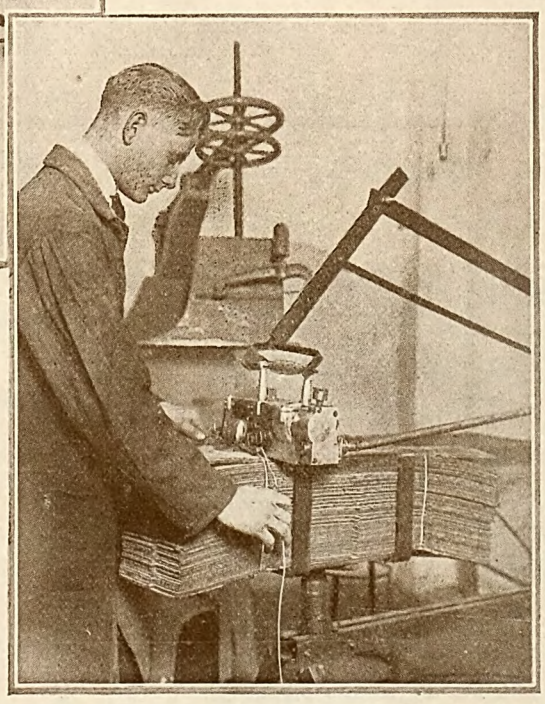


Various sizes and types of bundles tied by machine.

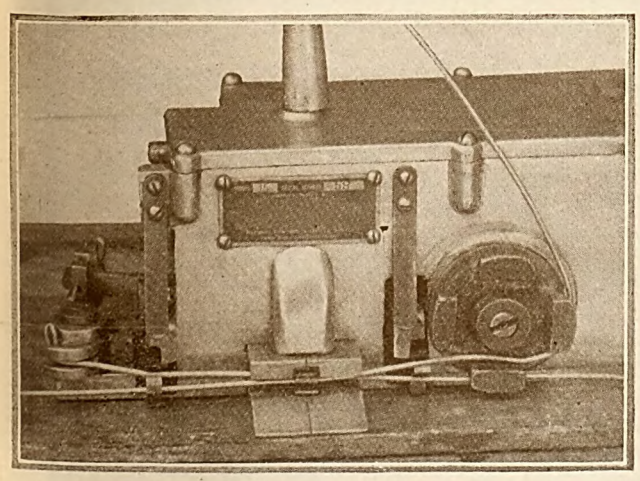
One end of a bundle of shingles has been tied, and the bundle is being swung around so that the other end may be tied.



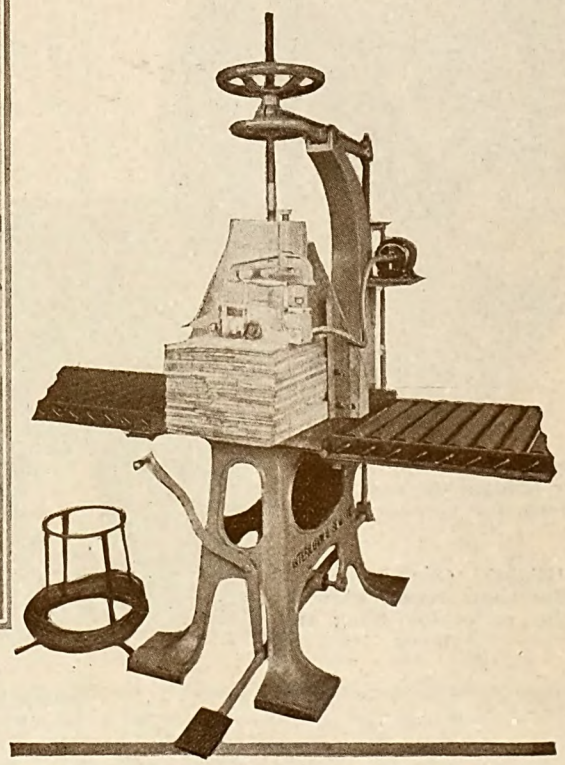
The completed bundle.



Operator ready to cut the wire after tying a bundle.



Details of the tying mechanism, with wire in place on rotating tension drum.



Tying machine, as used in conjunction with gravity conveyor in the packing department.

While the economy and strength of metal-reinforced wooden packages has long been recognized by shippers, not much use of this style of package has been made in the past because there was no machine capable of doing the wiring or strapping easily, quickly, and economically. The recent invention of a wire binding machine, however, points the way to better bundles for manufacturers of various products—almost anything, in fact, from a wooden pail to a bundle of boards.

Not only does this device wire cases and bundles in a satisfactory way, but it also seals the package, as it were, since it is impossible to replace the wire after it has been removed, thus providing evidence of plundering during shipment and giving the shipper a good claim for damages.

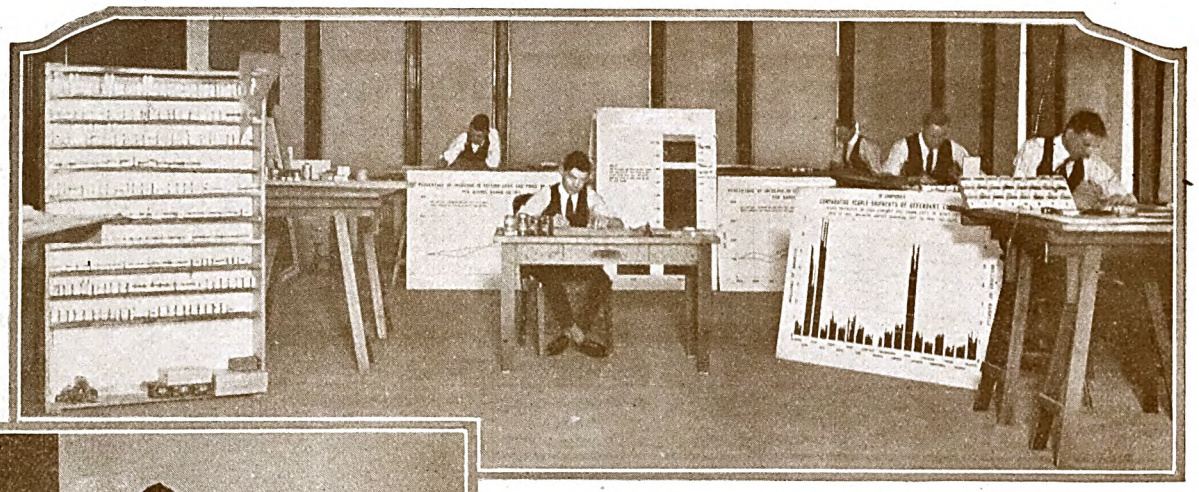
In the wiring of boxes this machine possesses numerous advantages over any other method heretofore employed.

(Continued on Page 32)

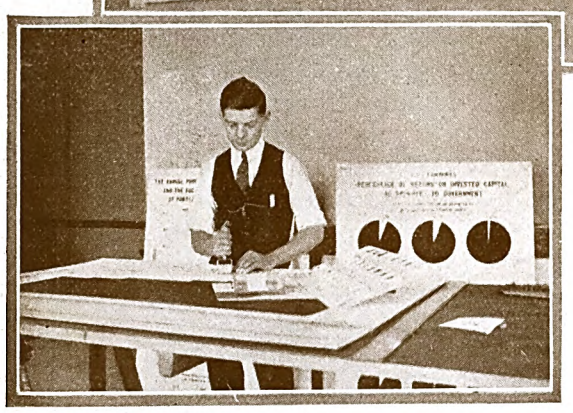
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The Use of Large Graphic Charts in Litigation

By Joseph G. Breaznell

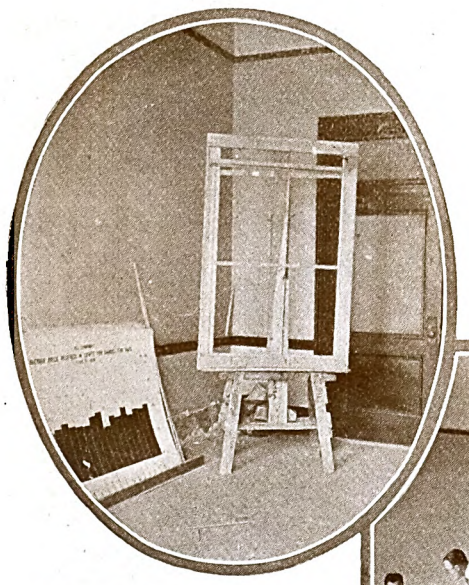


As fast as the charts were plotted, they were taken into this room for painting and lettering; being then checked, photographed and filed for ready reference.

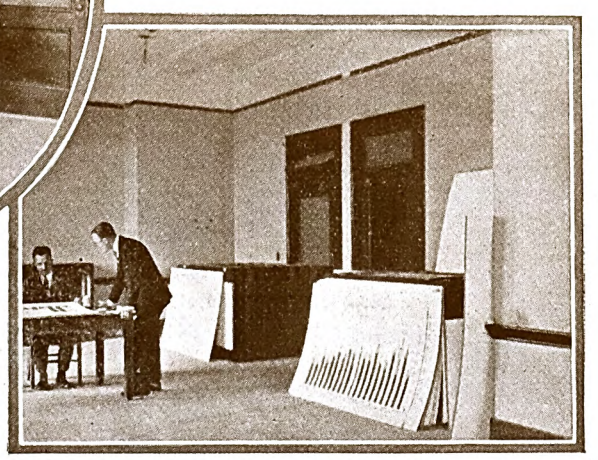


Putting the gummed letters on a chart. Note the clear-cut appearance of the charts in the background.

Fig. 1—Flow chart of chart production, showing steps in the construction of charts.



(In oval) The frame for holding the completed charts for photographing.



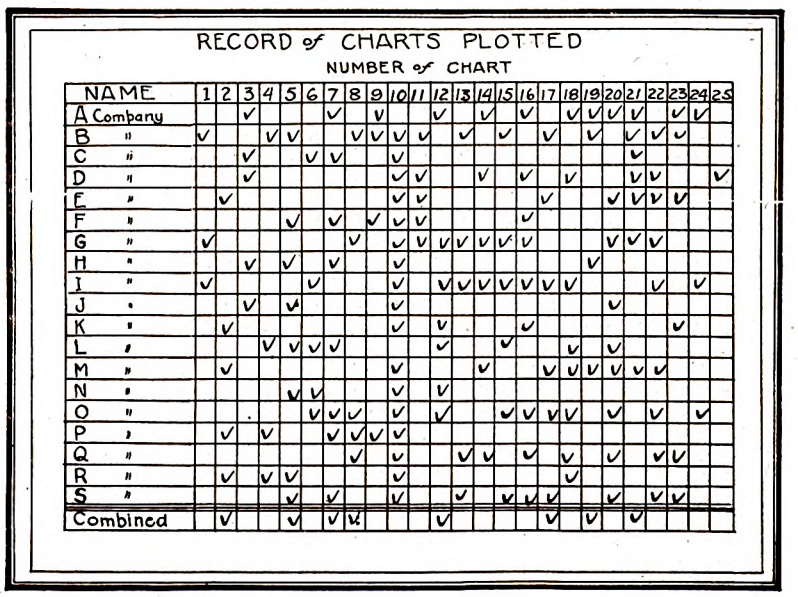
(Right) One corner of the chart room, showing the racks for filing the charts.

In the recent trial of certain of the eastern cement manufacturers in the United States District Court, Southern District, New York, for alleged infractions of the Sherman Anti-Trust Law, large graphic charts played a prominent part in the defence.

Some five hundred graphic charts were constructed under the direct supervision of the writer in a period of less than three months. Of this number of charts, about one hundred and ten were exhibited during the trial and offered in evidence by the defence. While the balance were not shown in court, they were invaluable in studying the conditions and records of the various manufacturers.

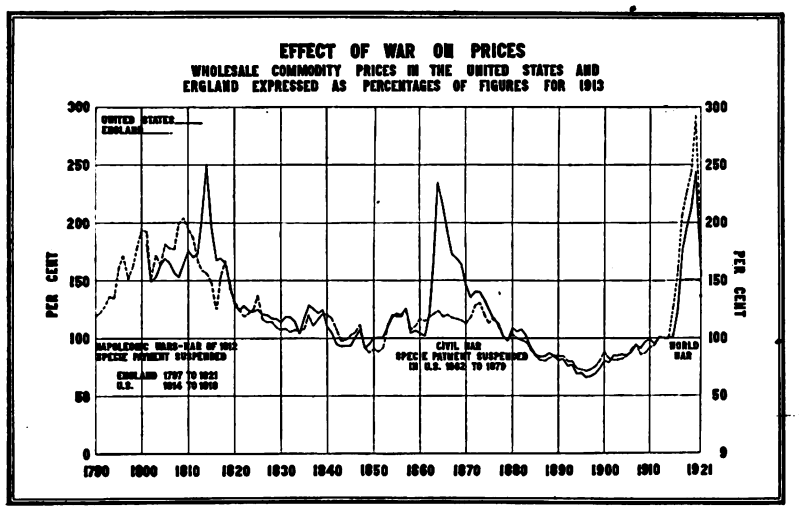
Charts were used in order to provide a way of showing at a glance the true condition as reflected by the great mass of figures showing the costs of manufacture and the financial conditions of the cement companies involved. Charts on general business conditions were a part of the number made and provided a comparison with the business done by part of the cement industry during the period of from 1913 to 1921.

The charts were made on large sheets of drawing paper mounted on cardboard. They were so designed and constructed as to clearly be vis-

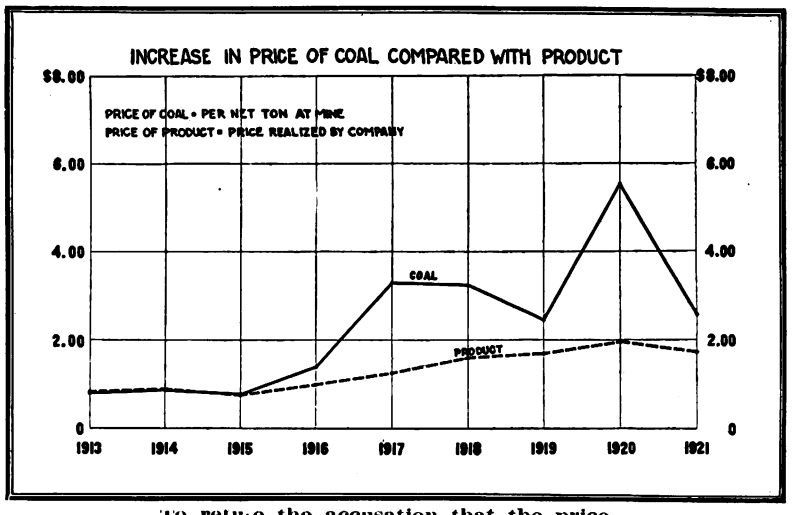


Score board, on which record was kept by means of serial numbers assigned to each chart.

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The effect of war on prices is illustrated by this chart. The solid line represents the increases and decreases for the United States and the broken line for England. This chart is valuable in showing that the recent war, like former ones, was the direct cause of a great increase in prices.

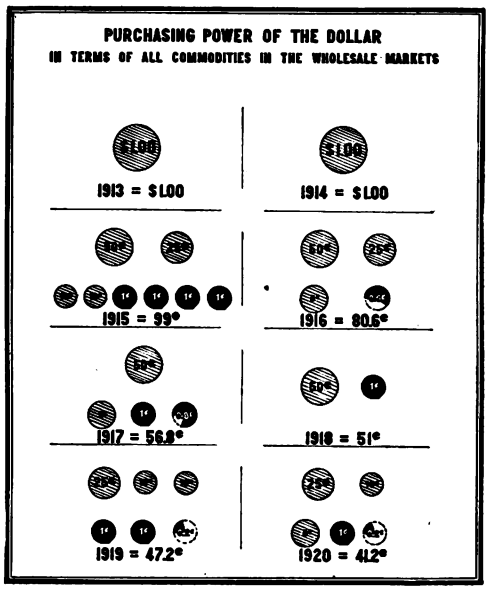


To refute the accusation that the price of a certain finished product has increased abnormally during the period charted, a comparison is made with the increase in the price of coal. In this case coal is one of the most important materials entering into the manufacture of the finished product. In the case of other products a comparison may be made with the increase in price of one of the most important raw materials needed in the manufacturing process.

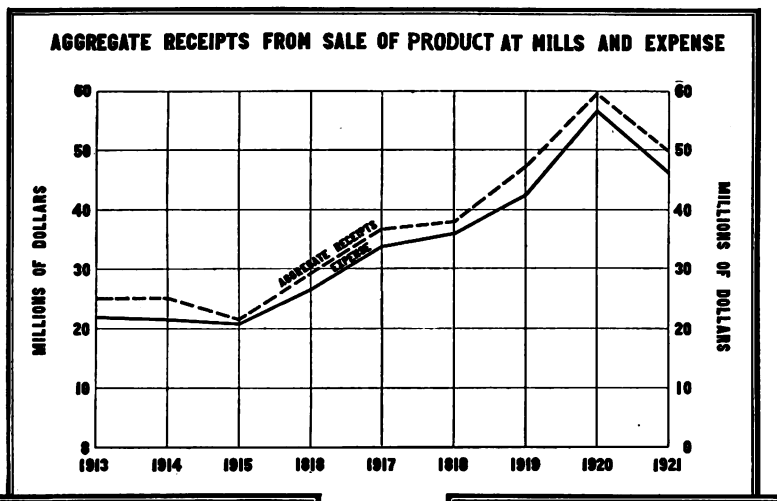
ible at a distance of twenty-five feet or more. The standard size was 40 by 60 inches. This size of sheet was large enough to permit the charts to be drawn to the required scale and was not too large for convenient handling. The cardboard backing made the charts easy to work on and greatly helped by facilitating their handling.

During the period of the work, from four to fifteen men were employed. Eight drawing tables were used, three fitted with automatic straightedges for drawing the cross section lines and plotting the data, and the other five for painting the bars and lettering the scales and titles.

The graphic chart work was done in two rooms. The three tables for plotting were in a room adjoining that in which the accountants prepared the figures. As fast as the charts were plotted they were taken into the other room for the



Everyone is vitally interested in what the dollar will buy. The above chart shows the relative purchasing power of the dollar based on the amount it would buy in 1913 as 100 per cent. The use of symbols representing coins to graphically illustrate the declining value of the dollar gives to the lay mind the significance of these figures in a very striking manner.



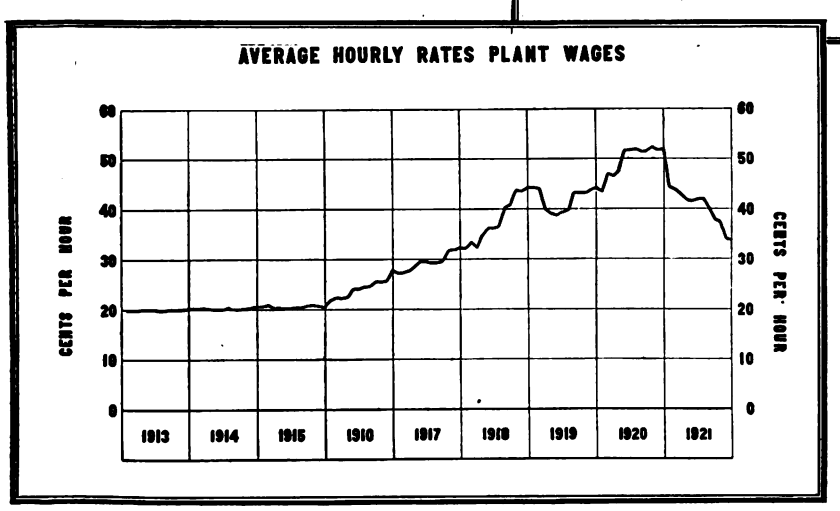
This chart clearly shows that while the receipts from the sale of the manufactured product have grown greater over the period charted, the expense of manufacture has also risen at the same, and at times at a greater rate.

painting and lettering. Here they were finished up, checked, photographed and filed in cases for ready reference in conferences.

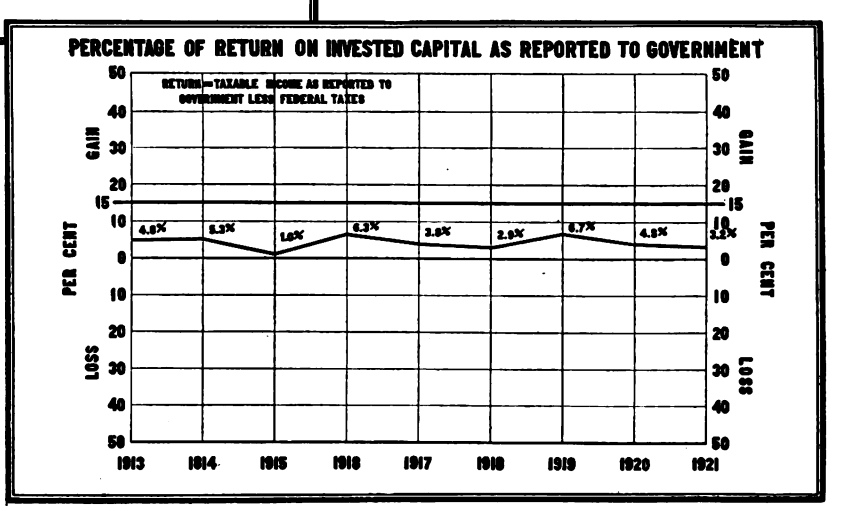
Fig. 1 is a flow chart showing the steps in the construction of the charts from the time that the data was submitted to the filing of the finished product for reference.

A list of the charts to be made was prepared and from this list the accountants made up the working sheets on which were tabulated the data to be graphically represented.

(*Continued on page 48*)



This chart shows the average hourly rates of wages paid to the workers of a plant. The monthly averages over the period of years from 1913 to 1921 show an increase to meet the rising prices in the cost of living.



Fifteen percent is considered a fair return on invested capital for industrial concerns by many authorites. This chart shows that in no year during the period represented on the chart did the return of the company exceed 6.7 percent. It will be noted that in the year 1915, the return was but 1 percent.

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Handling 3000 Tons of Mail a Day

Mechanical Equipment of the New Chicago Terminal

BY ROBERT H. MOULTON

NOT so many years ago, if you wanted to send a letter from New York to the Far West, the postage alone cost as much as a good dinner; and the letter, traveling by Pony Express, might (or might not) reach its destination in the course of a few weeks. Today, your letter reaches its destination all the way across the continent, in as many days—and the postage is but two cents. Which is merely another illustration of what mechanical methods have accomplished.

Picturesque, romantic, and comparatively simple, the Pony Express was adequate to handle the small amount of mail matter in its day. As the railroads pushed their way westward, conditions changed: increased population brought with it an increase of transcontinental mail; the vast number of periodicals of national circulation that sprang into being helped to swell the total; finally, the parcel post introduced a new and serious problem in mail handling.

Meanwhile, as the railroads took over the task of transporting mail, transcontinental mail routes came to be more and more centered at one point —Chicago. Through the Union and Northwestern railway and the adjacent stations in Chicago, flows the mightiest flood of postal matter that is centralized at any one point on earth. Mail from every hamlet, village and city in the nation is constantly passing through these terminals. Until recently, however, the railway mail service at Chicago operated under adverse conditions in the form of facilities that were inadequate for the rapidly increasing volume of business.

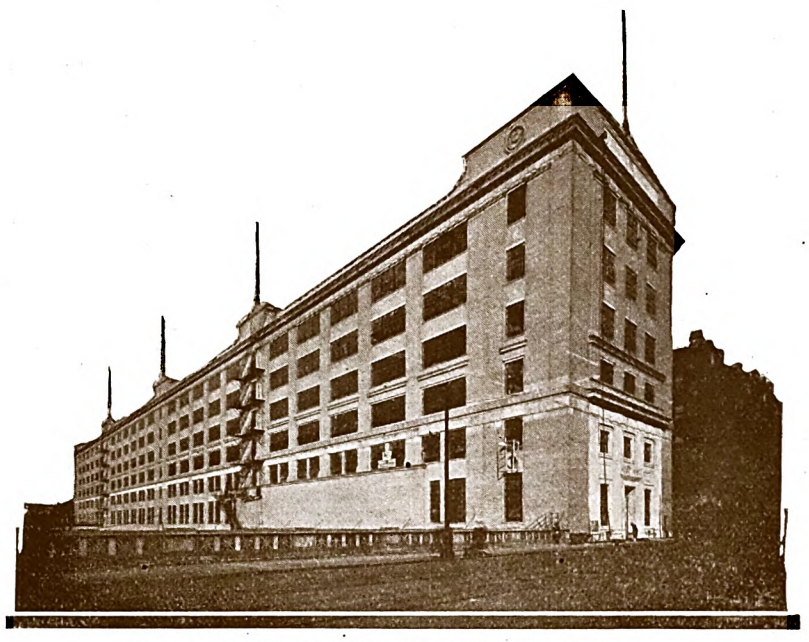
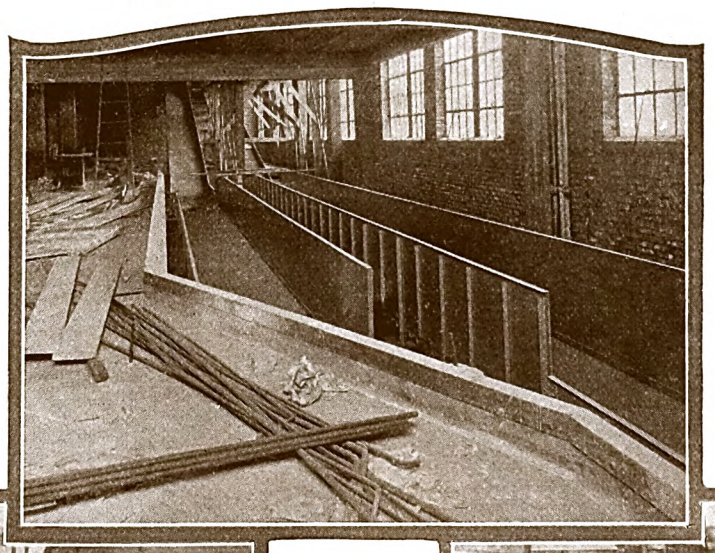


Fig. 1—New Mail Terminal Building, Chicago.

In 1919 a committee of the railway mail service made a thorough study of the operations at Chicago. As a result of this study, the necessary facilities to correct the existing conditions, and a comprehensive scheme of terminal operation was adopted. The plan called for a site conveniently located for both railway mail cars and auto trucks; a building of adequate dimensions and design in which to handle the mail economically; and an extensive application of mechanical apparatus.

The result of all this is that there has just been completed, as a part of the new Chicago Union station project, a railway mail terminal building which is unique among such structures. It is not only the largest existing building of its sort, being

Fig. 2—Conveyors 1 and 11, which receive the precancelled mail brought in from outside.



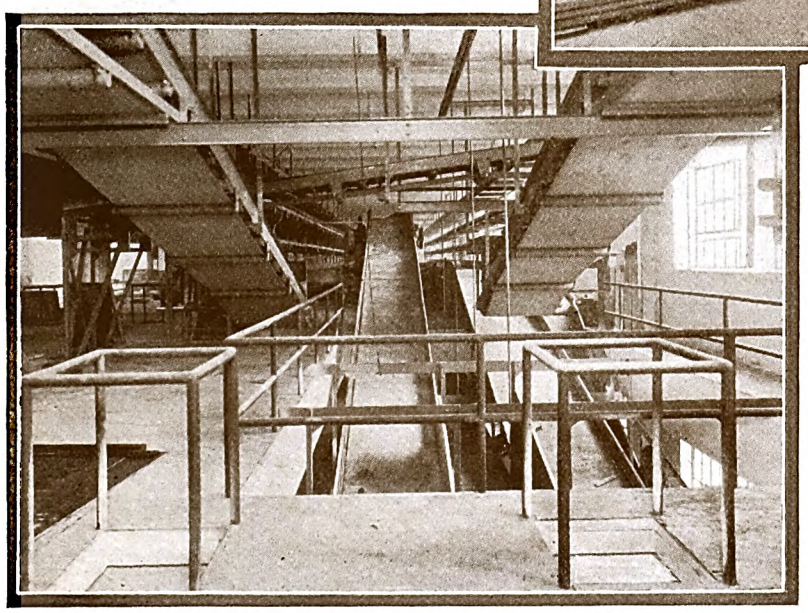


Fig. 3—Showing the top of the feed belts 1A and 11A coming up to the third floor Separation Unit.

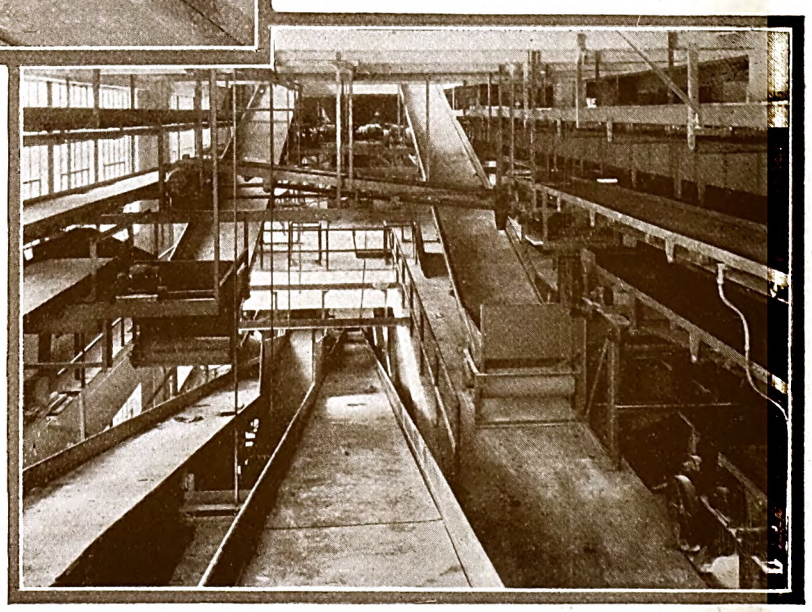


Fig. 4—Showing the bottom of belts 3A and 13A, which feed the state belts for Missouri, New York and Kentucky, and a view looking down belts 1A and 11A.

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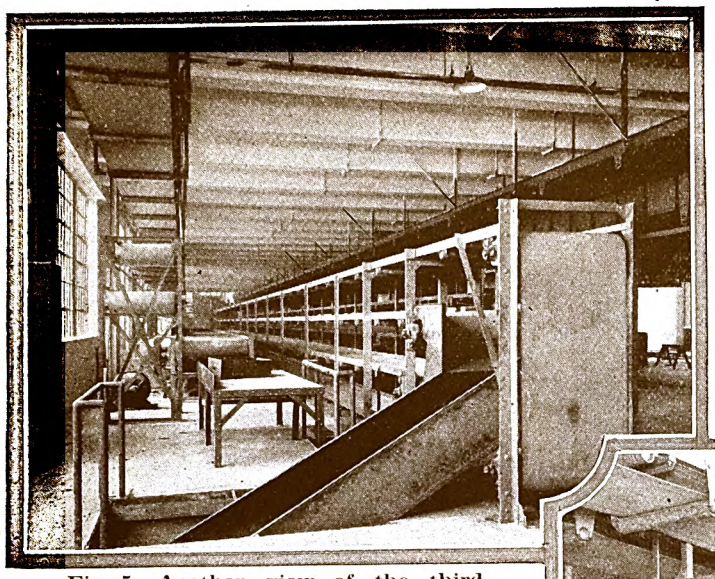


Fig. 5—Another view of the third floor Separation Unit, showing the farthest end of belt 1A.

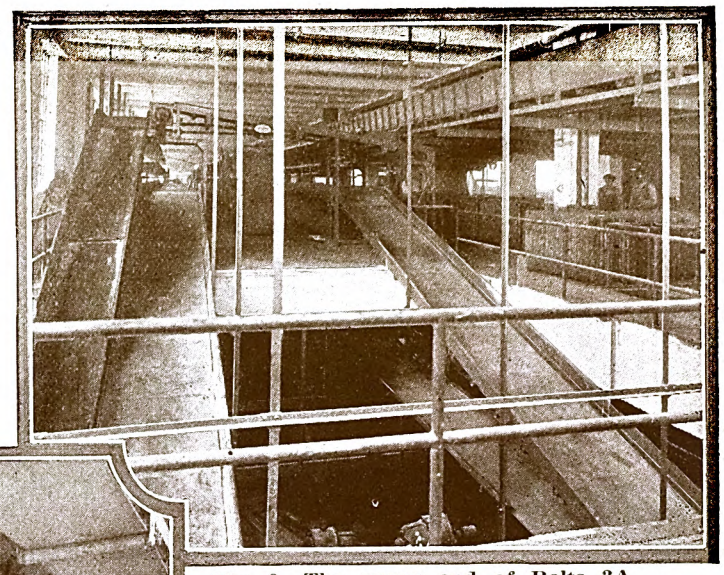


Fig. 6—The upper end of Belts 3A and 13A landing on the fourth floor and feeding the fourth floor Separation Unit.

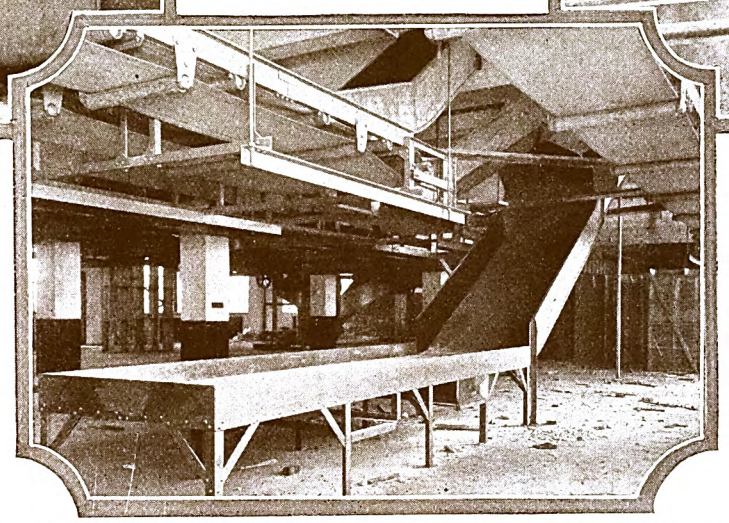


Fig. 7—The state belts deliver to individual State tables. The picture shows one of these tables. From these separation tables the bags of mail are carried in balanced type trucks to holes in the floor beneath which the ceiling bag conveyors operate.

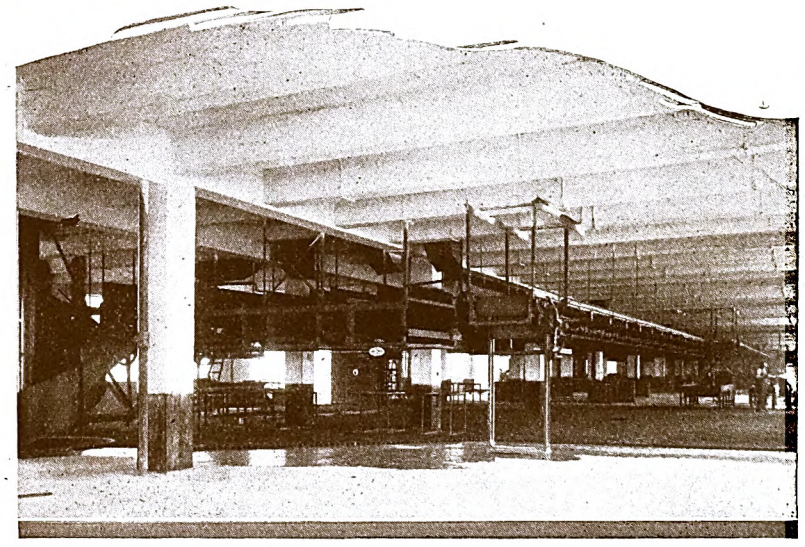


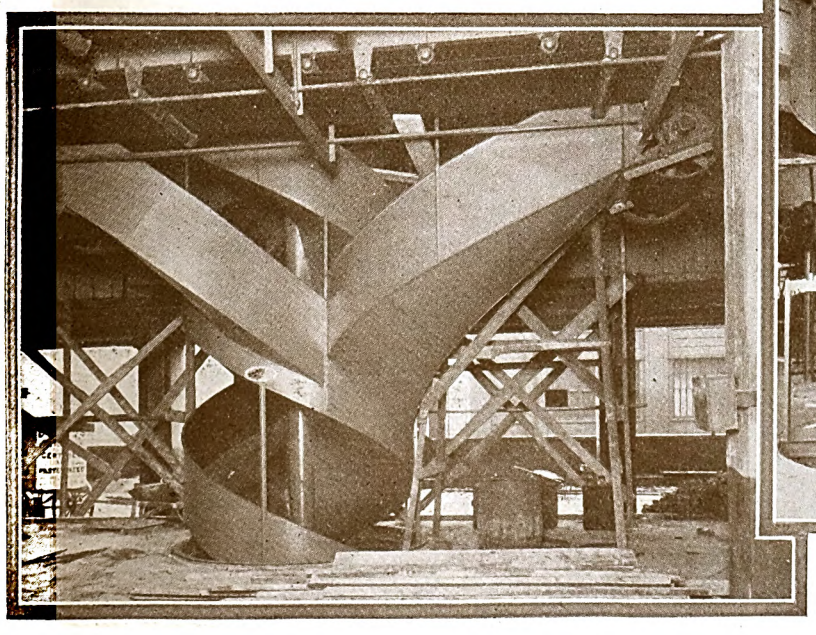
Fig. 8—Showing the ceiling conveyors and the small chutes leading to them. At extreme left is part of a spiral chute and the chute from ceiling conveyor to the same.

800 feet long by 75 feet in width, with a height of six stories above basement, track level and sub-basement, but contains mechanical conveyor and transportation equipment without an equal in the world. This equipment is capable of handling 3000 tons of mail each 24 hours. A further idea of the magnitude of the operations carried on in this terminal will be gained from the fact that more than 1000 clerks and porters are employed in the railway mail terminal department alone.

The mail terminal building extends from Van Buren to Harrison street, between Canal street on the west and the Chicago River on the east, with a private driveway along the full length of the east side. The building is of the latest fireproof design of steel and concrete, and is furnished throughout with factory-type steel sash to provide the maximum light and ventilation. Its floor capacity is 500,000 square feet. It is of the two-level type and is served by platform tracks on the lower level and a teamway on the street level; the private driveway referred to affording 580 feet of clear tailboard space, or enough for 60 street vehicles at one time. The track level has platform lengths adequate to serve 61 cars, while the basement affords communication, by means of tunnels, with cars at Union station platforms remote from the mail terminal.

Perhaps the most notable feature of this terminal is the system of belt conveyors em-

Fig. 10—Spiral chute B at the first floor, to which conveyors deliver on both sides. In the center may be seen the spiral leading down from floors above. At upper right is seen a heavy drive pulley.



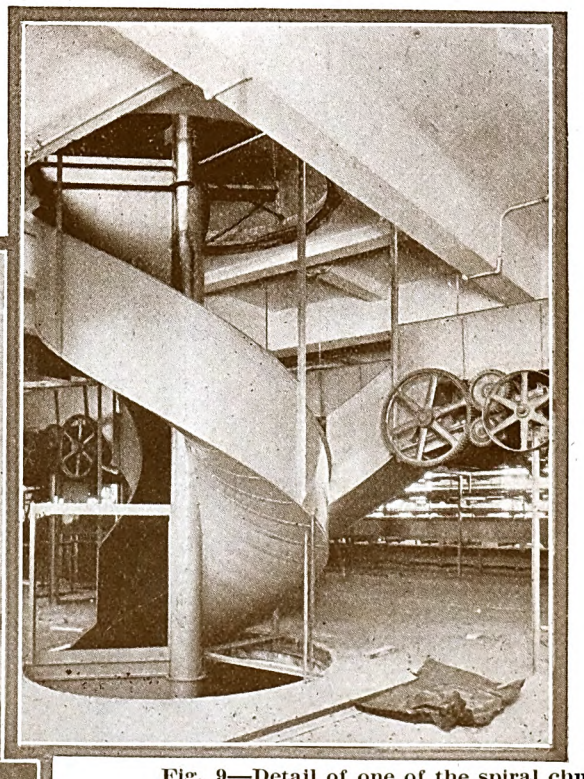


Fig. 9—Detail of one of the spiral chutes with delivery from head of conveyor with the chute. This also shows the driving mechanism at the head of one of these conveyors.

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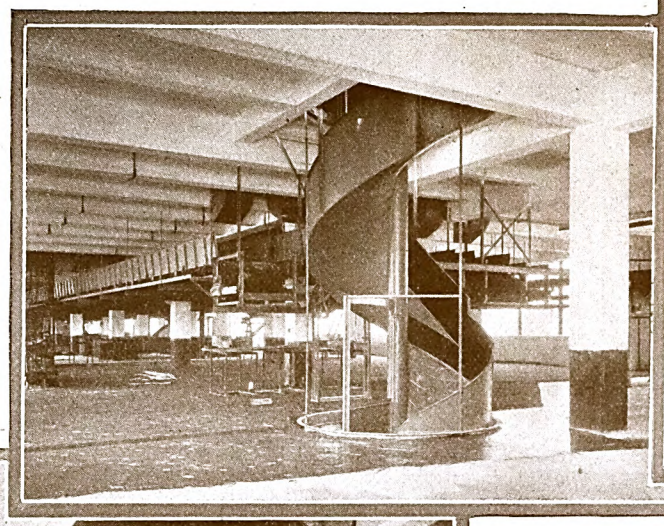


Fig. 12—Another view of spiral C (shown in Fig. 11). These views are typical of the different floors.

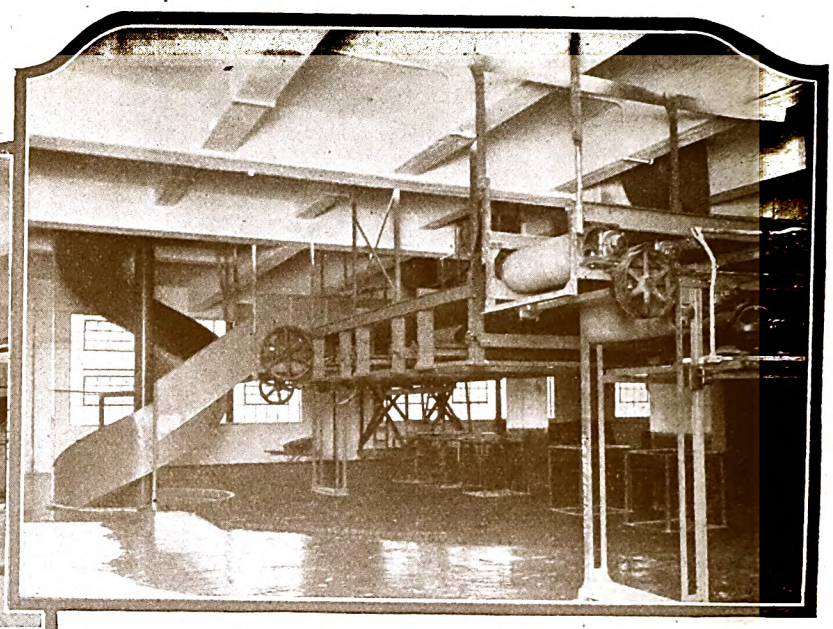


Fig. 11—Showing Spiral C at north end of building. There is only one conveyor on each floor delivering at this end of the building. The other conveyors have their take-ups at this end. These take-ups are 6 feet long.

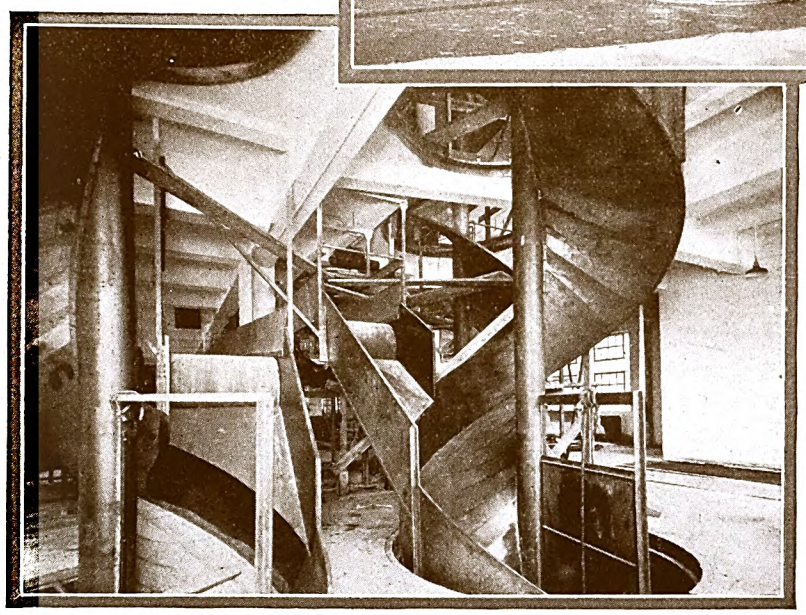


Fig. 13—Showing entrance of conveyors into Spirals D and E. At lower right is the type of fire-door used to seal up the opening in case of fire. This door is shown held up by a rope, but it will be held by means of a chain and fusible link.

ployed in the building. According to the resident engineer who has been in charge of the installation of the mail handling equipment, this system is the largest installation of its kind in the world. It consists of 71 belt conveyors, requiring the use of approximately eight miles of belting; 400 tilting trucks of a special design; 1,200 balanced type trucks of a standard type; and a sufficient number of tractors to handle the trucks effectively throughout the building. In addition to these facilities there are 15 freight elevators, approximately 8 x 18 feet each.

The terminal has a variety of functions. One of the most important is the handling of mail received from and delivered to trains at the Union station; consisting primarily of the transfer of mail sacks from street vehicles to mail cars and vice versa. A great part of the operations of the terminal, however, consists in

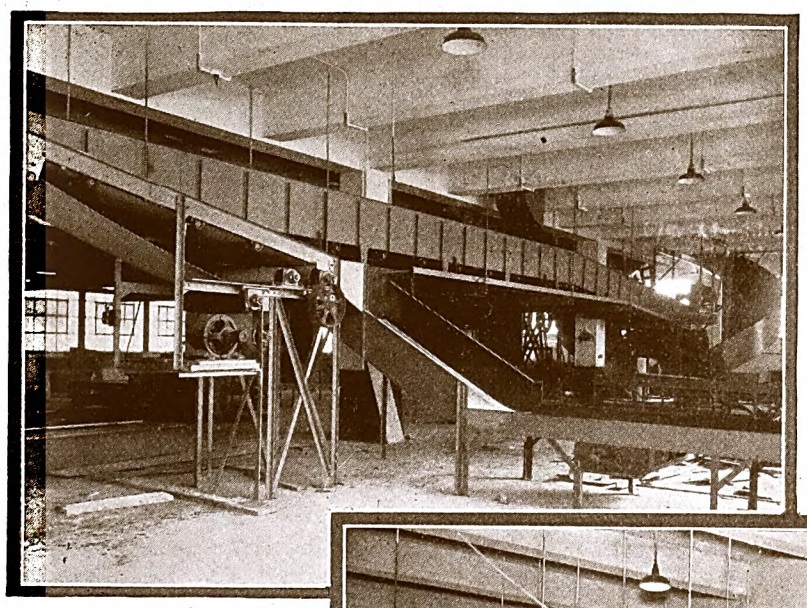


Fig. 14—Showing the delivery from a state belt, also the light drive used for state belts. Dust-proof roller bearing housings show at upper left.

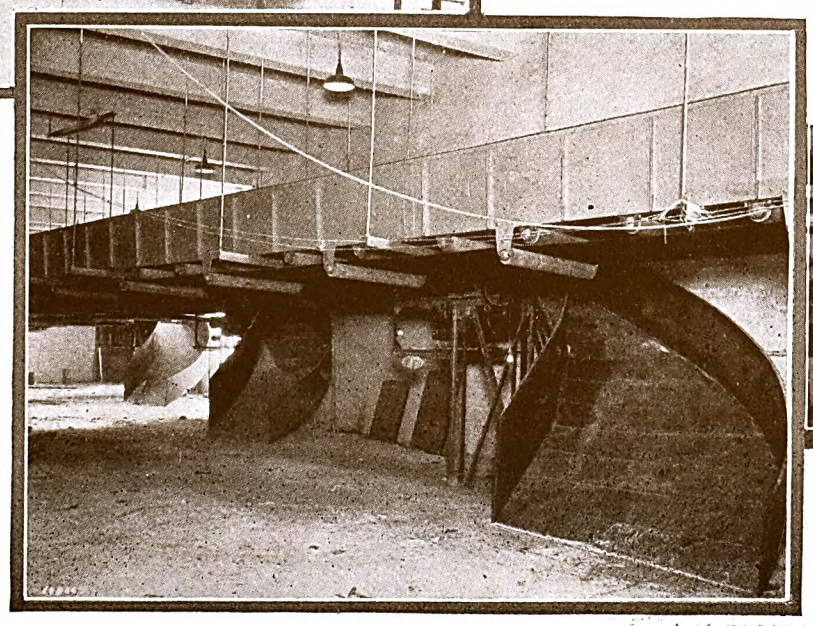


Fig. 15—Showing delivery at first floor from Skew-belts.



Fig. 16—Workmen making a splice in one of the canvas belts. Flexible lacing is used. The ends of belts are pulled together by means of clamps, and the teeth mesh together with a strip inserted to keep them from pulling apart.

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Fig. 17—The Station controlling panel, separation unit.

the receipt, classification and dispatch of all papers, catalogues and parcel post mail originating in Chicago, as well as mail of these three classes passing through the city. While the bulk of the material is received in the terminal already weighed and with the postage canceled, a portion of it has not undergone these operations, and to take care of the latter a post-office has been provided in the building.

Unclassified mail reaching the terminal from the street is received along the middle portion of the private driveway space; that from trains, on the basement or track level. From these two points of receipt it is delivered to the upper floors of the building for the necessary work of classification.

Formerly parcel post mail originating in Chicago was sacked and loaded into trucks at business houses and transported to the mail station. From 25 to 30 minutes were required to load a truck and a similar length of time to unload it. Under the new system the same work is done in from three to five minutes at each

(*Continued on page 70*)



Fig. 18—Balanced type trucks similar to those used to transfer bags of mail from the separation tables to the holes in the floors connecting with the ceiling bag conveyors.

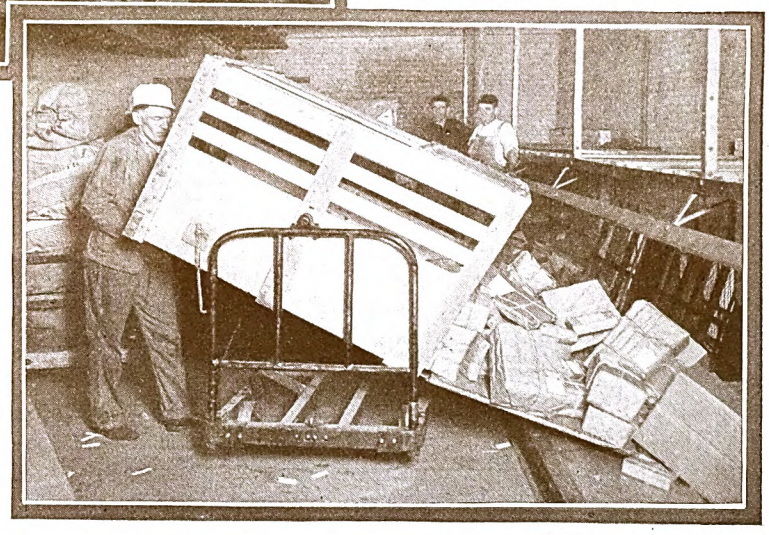


Fig. 19—Showing how packages are unloaded on to conveyor. Tilting trucks used to bring mail from large firms in motor trucks to Post Office. There are 400 of these trucks.



Fig. 20—One of the Tilting Trucks loaded with packages.

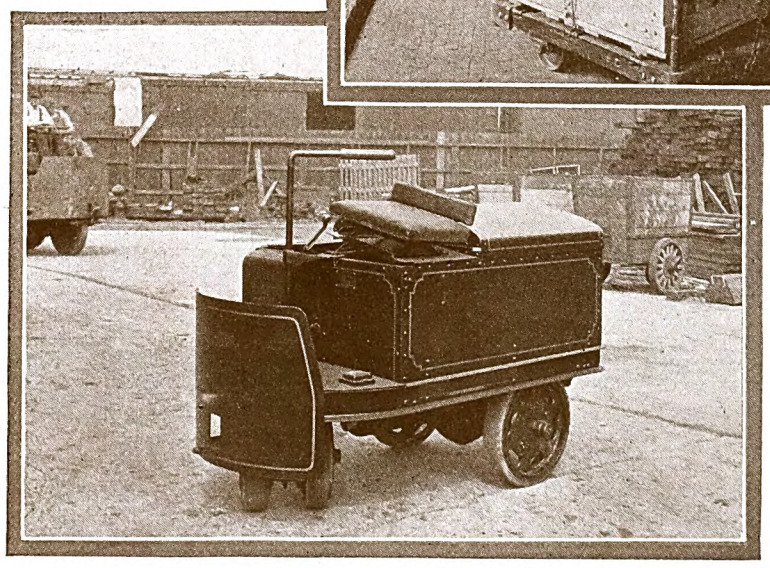


Fig. 21—Tractor, used to take mail sacks to mail cars after sorting.

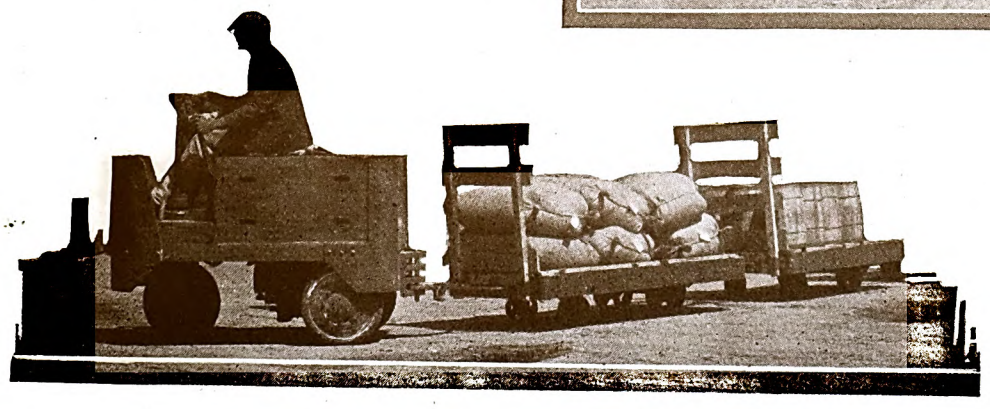


Fig. 22—Another type of tractor used in connection with the small mail trucks.

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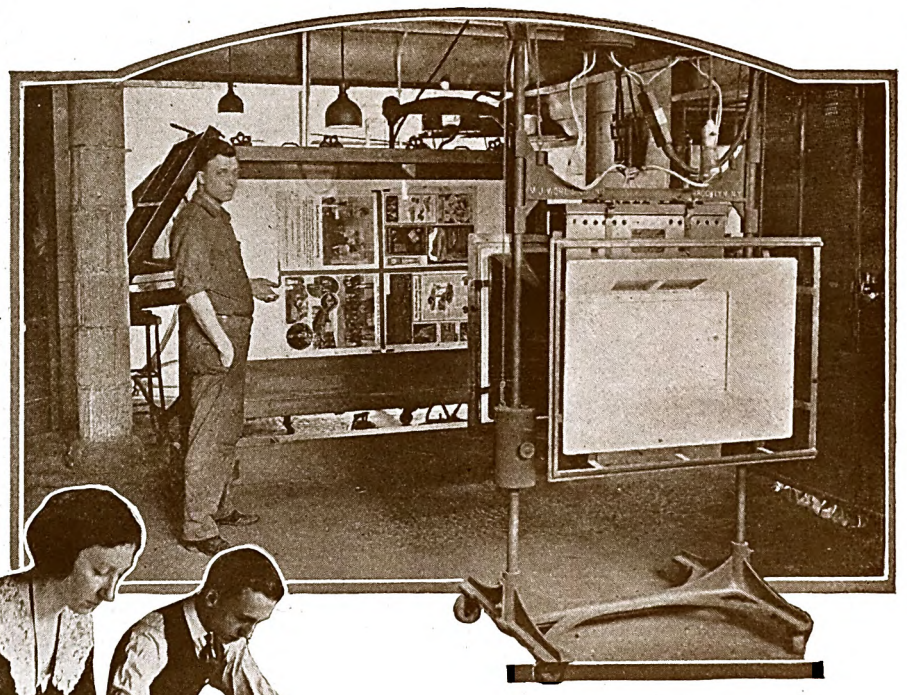
The Modern Version of an Old Art

How Mechanical Methods Have Developed Rotogravure from the Old Photogravure Process

By S. T. Thorogood

As you loaf at your shirt-sleeved ease of a Sunday morning, puffing the jimmy-pipe and browsing through the picture section, it may seem a far cry from the paper on the wall to the paper in your hand, the shirt on your back and the copper-plate calling cards in your vest pocket. But, from the printing point of view, they "are sisters under the skin." In each case what you see—wallpaper pattern, shirt stripes or figures, beautiful script on the cards, and pictures in the paper—is put on the paper or fabric by a printing process which is fundamentally the same, though the appliances employed differ so radically they hardly seem to belong to the same family, any more than their products do. But it is all intaglio printing. The earliest form of this process is the hand-engraved copper plate. The latest is rotogravure, modern of the moderns, a completely mechano-chemical process.

All printing falls into three classes, and only three. It must be typographic as it is called, when the printing face of the type or plate projects in letters, lines or dots which take the ink, while in between are the gaps or hollows where the paper is not to be printed. Or it must be planographic, as in a lithograph, where the printing plate or stone has a



1—A big camera which photographs a positive of four newspaper pages. The carbon negative from this camera is placed on a copper cylinder and its impression is etched on the copper by means of acids. The newspaper is then printed with the copper clyinder, which process gives the page its soft, velvety finish—the finish which makes rotogravure in newspaper supplements, magazines, etc., so popular with the reading public.



2—The man at the left is scraping out the margins on a page of film from which the carbon sheet used in the etching process is made. The woman and the man at the right are cutting out pictures from sheets of film. These cut pieces of negative are afterwards put in their proper places on a page and a positive is made.

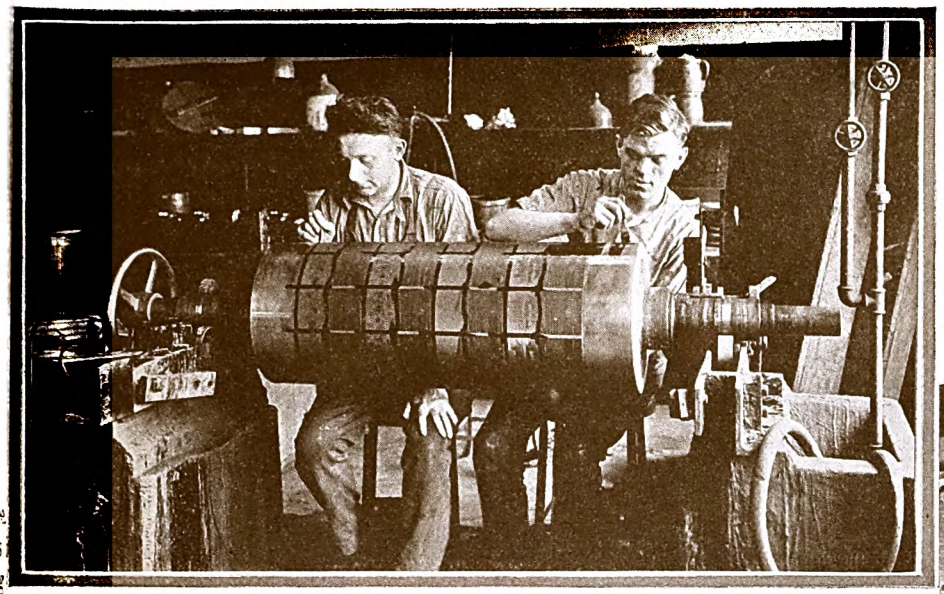


3—After the pictures for a page are photographed and a positive is made, a retoucher touches up the positive before the carbon sheet is made for the copper cylinder. Here you see a picture of a retoucher at work.

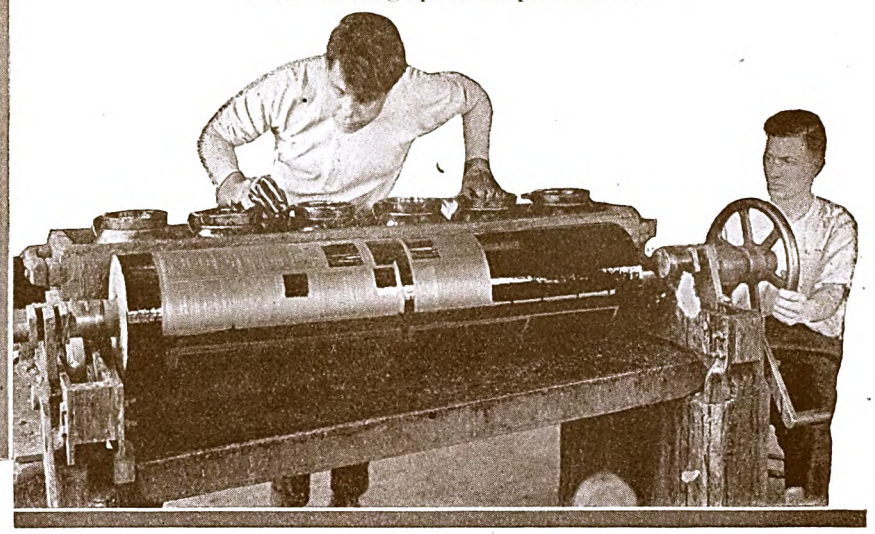
4—Putting the carbon sheet from the camera on a copper cylinder. The carbon is put on smoothly and then the pictures and type are etched on the copper by means of acids.



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5—Painting out the margins on a copper cylinder after the carbon sheet from the camera is put on. Black asphaltum prevents the etching acid from affecting the spaces that are to appear white on the printed page.

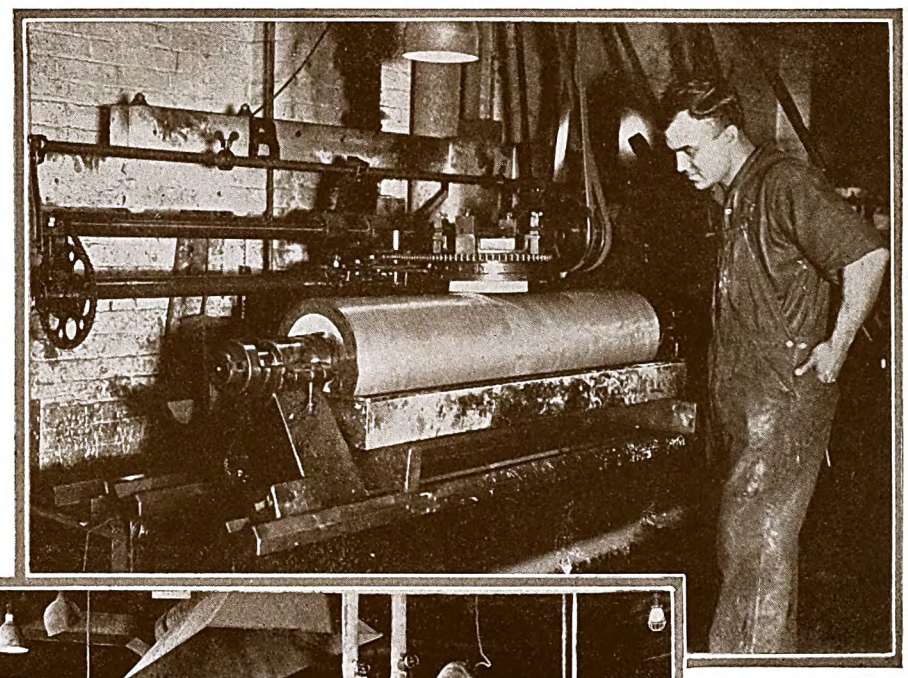


6—Etching pictures and type on a rotogravure press cylinder. Acids etch into the copper the impression on carbon sheet from camera seen in illustration No. 1. The black spaces are covered with asphaltum to prevent the acids from affecting spaces to print blank.

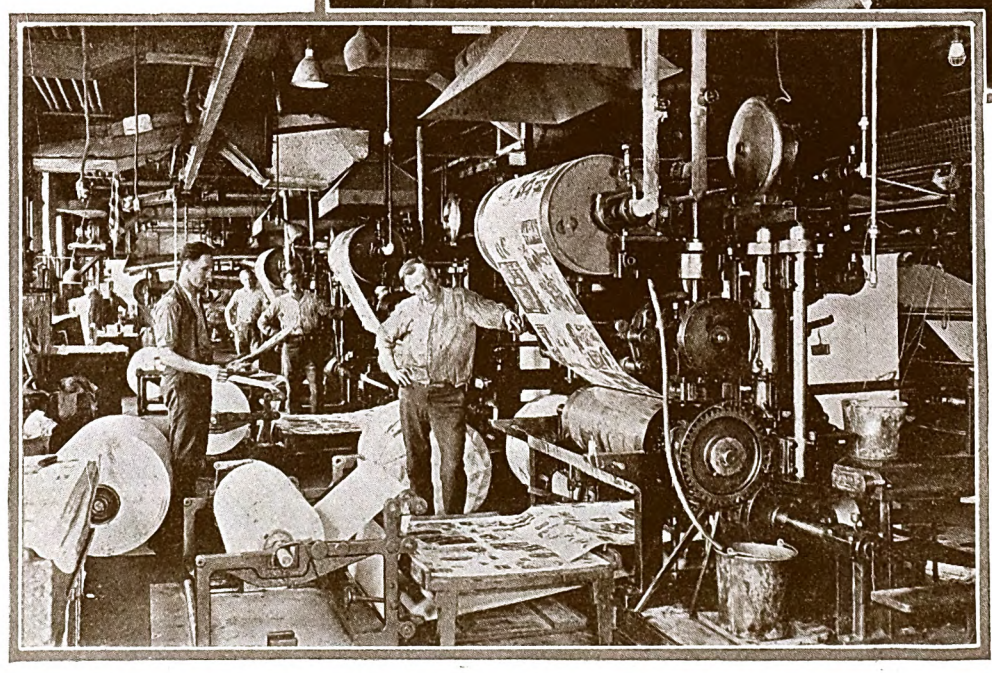
perfectly level surface, without projections or depressions, upon which the ink is laid. Or, lastly, it must be intaglio, in which case the ink lies in depressions in the surface of the printing plate or roll. The honey in a honey-comb, the capping of the cells having been removed, gives a rough idea of this process, on a very large scale. On the rotogravure printing roll the ink cells are, at most, 1/500″ square, and from .004″ to .009″ deep.

As in the case of so many modern processes, rotogravure is the refinment and speeding up of an earlier art. Photogravure has been familiar for a comparatively long time as a means of producing beautiful copies of the finest pictures. Its mechanical limitations restricted it to use in books, magazines and single copies for which a comparatively high price could be charged, to pay for the cost of production, and where the element of time permitted its slow speed. Rotogravure is simply rapid, rotary

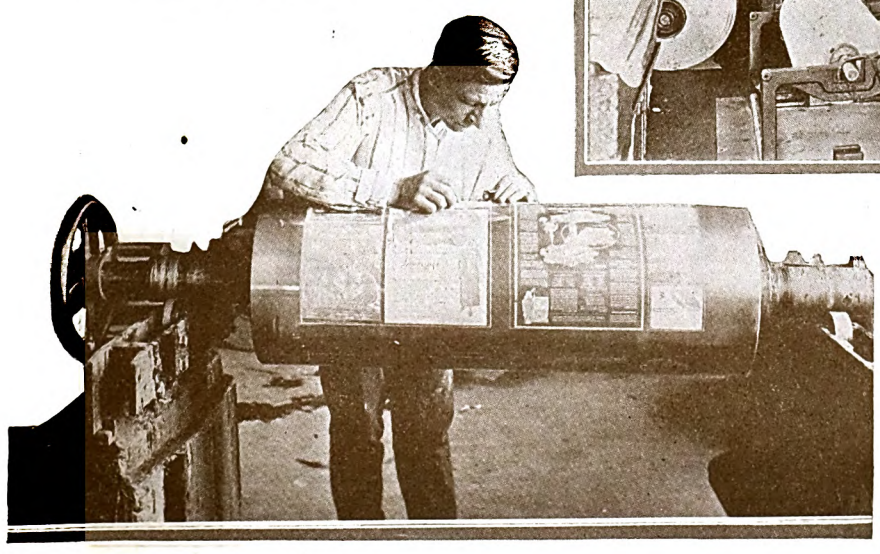
(*Continued on page 52*)



7—Grinding off a copper cylinder after it has been used in printing four pages of a rotogravure newspaper supplement. A Tam O'Shanter stone (imported from Scotland) cuts down the copper, removing the etching. This stone revolves and so does the cylinder; and the result is perfectly even grinding. When this process is finished the cylinder is used again, this being repeated until the cylinder is worn down too much to be used; whereupon it is given a new coat of copper.



9—General view of presses in one of the largest rotogravure plants in the country. The lower cylinders print one side of the paper, and there are cylinders in the rear which do the other four pages of the newspaper.



8—After four pages are etched on a copper cylinder, this man goes over the cylinder and corrects any small defects that may be seen under a magnifying glass.

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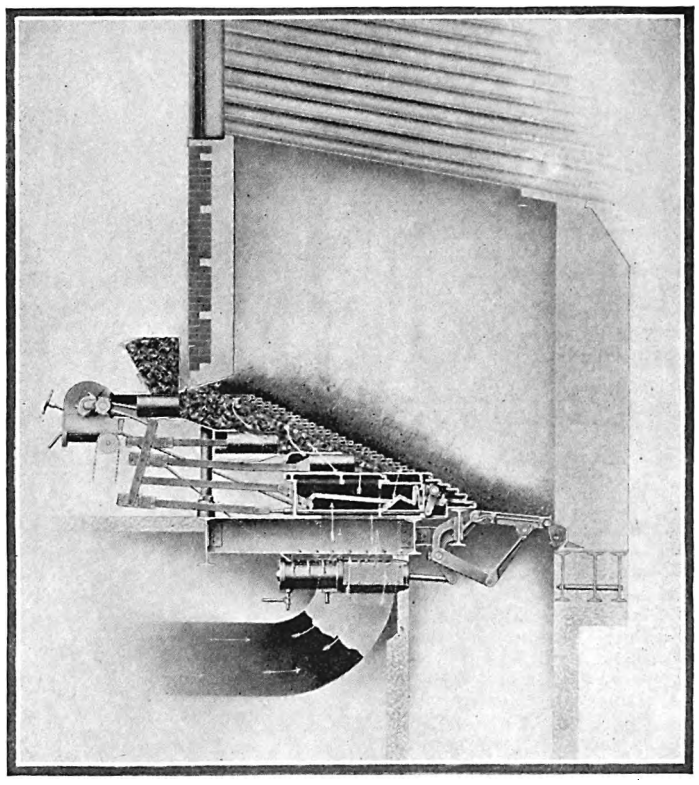
Ash Discharge on Underfeed Stokers

BY DAVID C. SPENCER

ONE of the problems which constantly confront boiler room engineers and operators, is the matter of cleaning fires and discharging the ash. To the average layman, this may seem like a simple proposition. In the case of small furnaces where operation is carried on at nominal rating or less, possibly the situation is not so difficult a one to handle. But in these days of large units and continuous operation at high over-ratings, the problem assumes an entirely new aspect.

Boiler operation may be classified in two groups. There is the station or plant whose load changes frequently, sometimes slightly, at other times in violent swings. The boilers may be delivering steam at 100% of rating at one minute, and be required to deliver 200 or 300% of rating five or six minutes later, with an equally sudden drop when the load goes off. Such experiences are not infrequent in Central Station practice or in such industries as pulp and paper mills, rolling mills, power stations of coal mines, etc.

Then there is the station whose load is fairly constant for an extended period of time. Such changes as occur are gradual and can usually be anticipated. There are practically no sudden fluctuations. Instances of this class are found in the case of power companies operating two or more stations, one of which carries the swing, while the others operate at a uniform rate. Among industrial plants a good example would be a shop equipped with machine tools or a spinning or weaving mill where production is fairly steady.



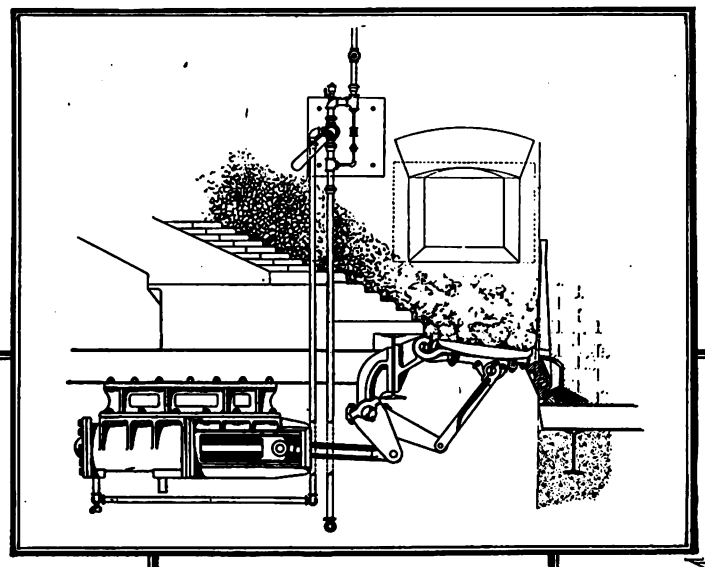
1—Cross section of stoker equipped with power dump showing characteristic outline of underfeed stoker firebed. Arrows indicate distribution of air.

It sometimes happens that one station will combine the characteristics of both classes; in other words, certain boilers are depended on to carry the average load, operating at the point of their maximum efficiency, while one or more additional boilers would be carried as standbys to pick up the excess load when required.

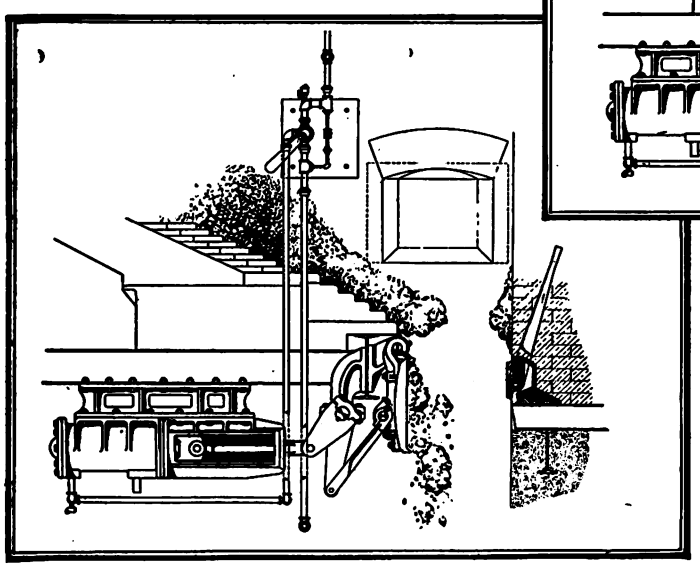
Each of these classes presents its own peculiar problem in the matter of cleaning fires.

In stations of the first classification, the operator's problem is to deliver steam when and in the quantity that is required by the plant processes. In the case of Central Stations supplying light to the community and power to the traction lines, a sudden storm, for example, means an instant increase in both the lighting and power load. This increase must be met and carried by the boilers.

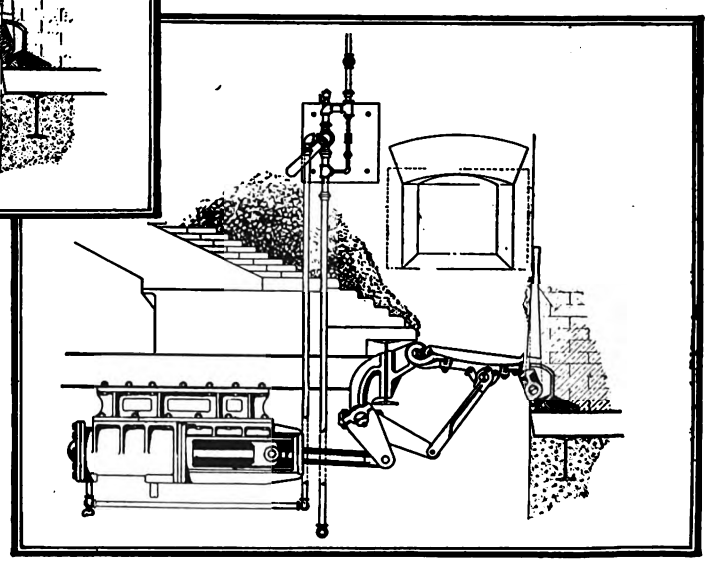
In the industrial field, the



2—Power dump ready to dump.



3—Power dump with plate dropped.

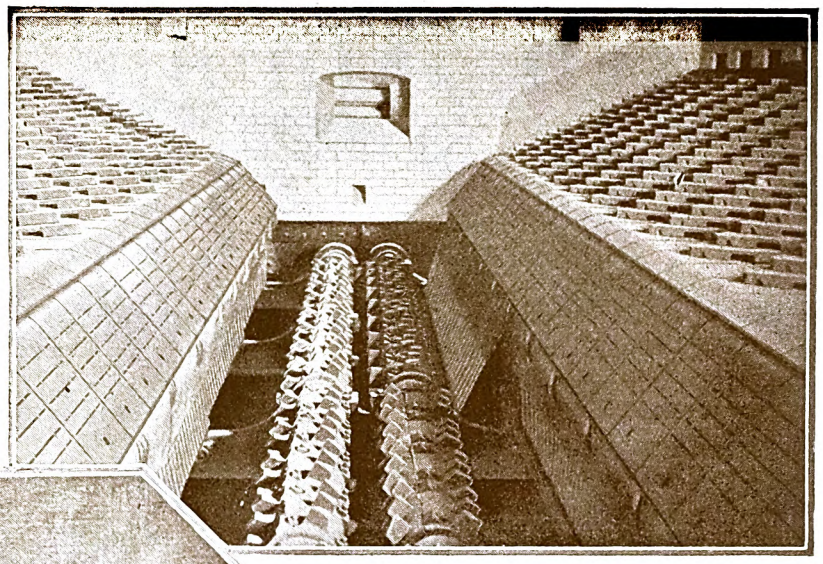


4—Power dump. Plate returned to running position.

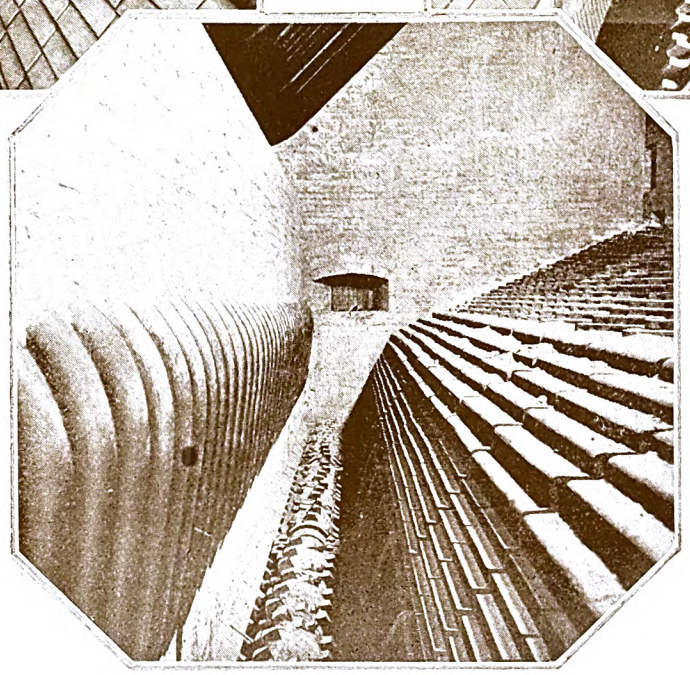
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5—Stoker in Hell Gate Station, United Electric Light and Power Company, New York City, fitted with rotary ash discharge.



6—Stoker in Solvay Process Co. Syracuse plant, fitted with rotary ash discharge. One crusher plate in running position with others wide open.



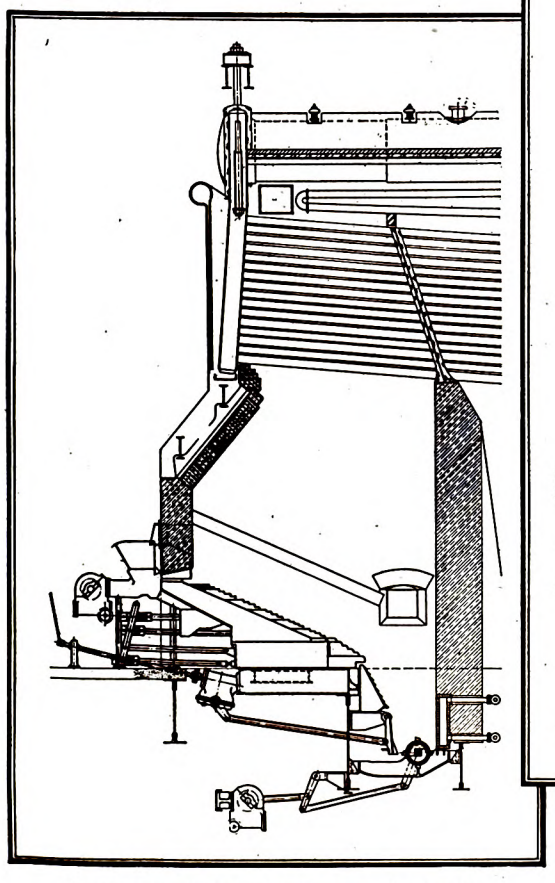
7—Stoker in Ford Motor Co. plant, Detroit, fitted with single-roll rotary ash discharge.

sudden call for steam for process purposes, as for example vulcanizing in the rubber industry, means an equally sudden peak which the boilers must take. The operator's problem in such cases is, as has already been stated, to deliver the steam. To accomplish that he must have an equipment that is highly flexible.

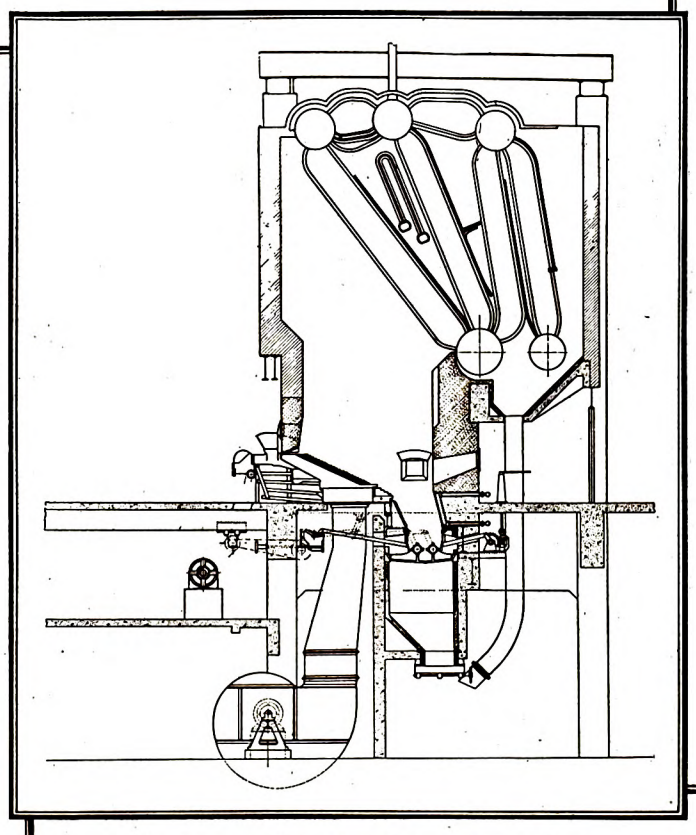
The elements which make for flexibility are the reserve capacity of the stoker and the ability to clean the fire quickly, easily and thoroughly and that the cleaning period should be variable at the will of the operator. The reserve capacity of the underfeed stoker is so well known as to call for little additional comment in this discussion. Suffice it to say, therefore, that the multiple retort stoker with its deep fuel bed provides in the greatest degree the first essential element.

The power dump is without exception the most satisfactory method of cleaning fires where conditions exist such as have been outlined. It gives the operator absolute control over his fire. He can, if necessary, increase the rate of coal feed to meet almost any contingency that may arise. Every operator knows that the question of capacity is largely one of the amount of grate

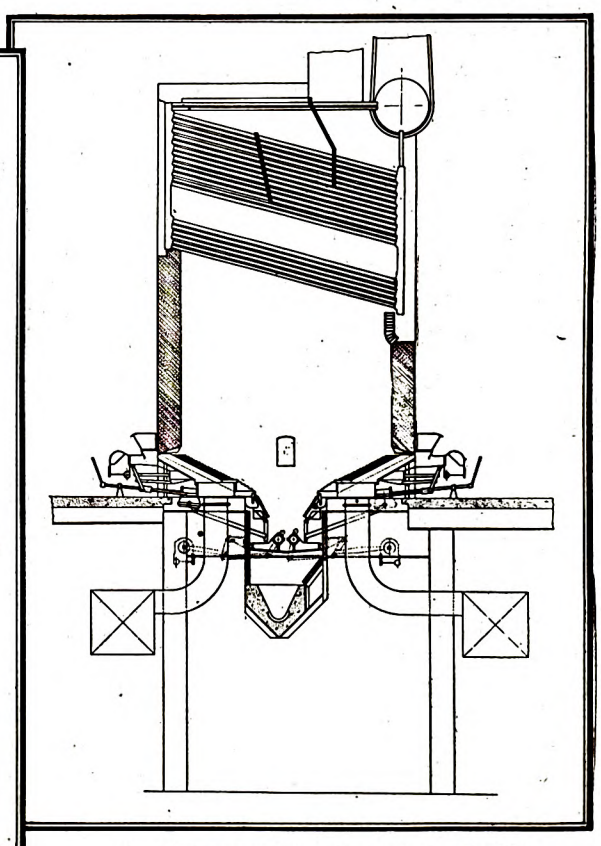
(*Continued on Page 34*)



8—Cross section of stoker with single-roll rotary ash discharge.



9—Cross section of stoker, single setting, with two-roll rotary ash discharge.



10—Cross section of stoker, double setting with rotary ash discharge.

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An Annihilator of Distance

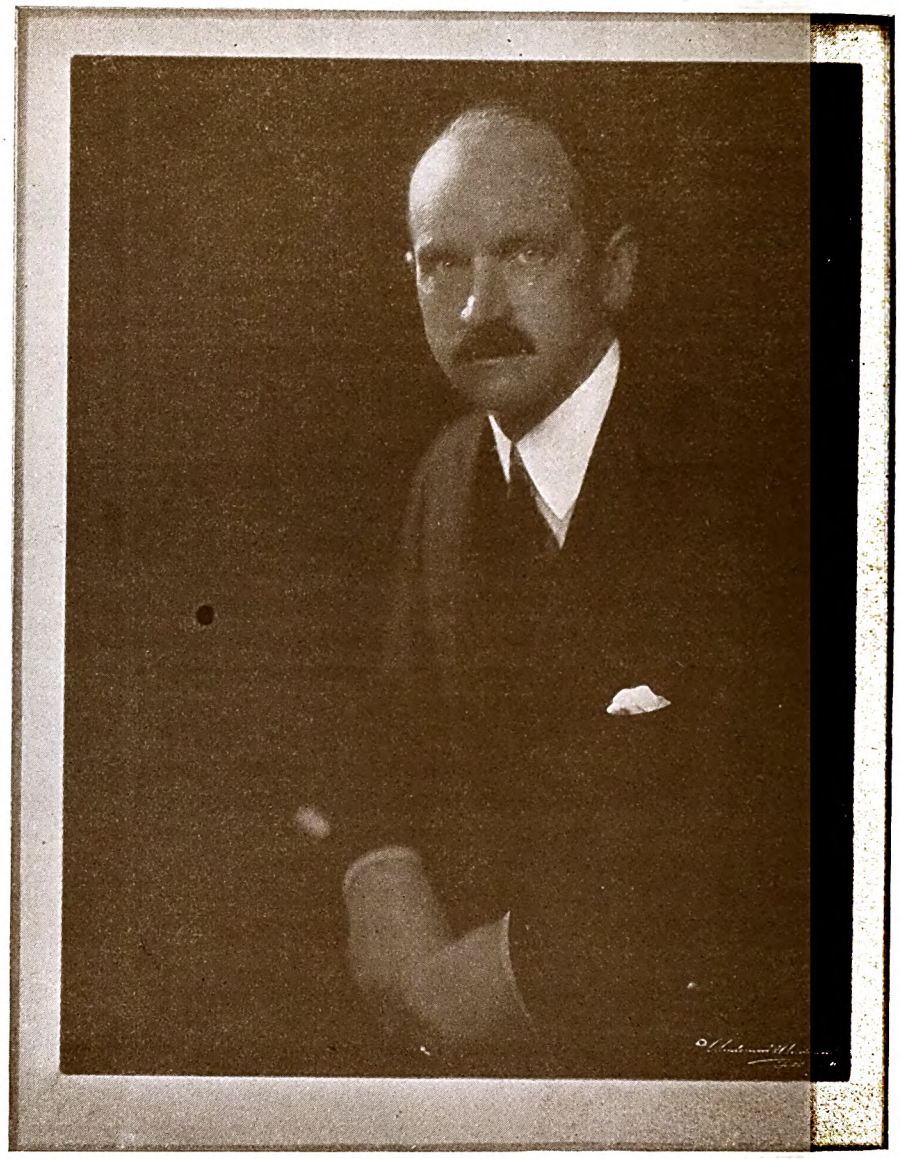
The Genius of Glenn H. Curtiss

By Ernest H. Rowe

PRE-EMINENTLY this twentieth century is the century in which the dreams of previous centuries are coming true; dreams so far from reality, some of them, that public opinion and science alike laughed them to scorn and burned the dreamers at the stake on the charge that they were demented or in league with the powers of darkness. The great Lord Francis Bacon began the new order by turning the brains of men about-face, changing the processes of thought from speculation to experiment, from the quoting of dicta to the observation of phenomena, from guess-work to actuality. Where he cleared the ground and laid the foundation the material structure of modern civilization is being reared, the mastery of nature is widening man's occupation of the empire which is his, according to the Psalmist: "Thou madest him to have dominion over the works of thy hands; thou hast put all things under his feet."

In groping fancy, with quaint device, those ancient inventors who dared the crushing public opinion of their time amused, amazed and sometimes terrified their contemporaries. Usually it meant their own destruction, either as the direct result of their attempts, or at the hands of the torturer and executioner. But the line of their succession was never broken, the torch that fell from their hands was never quite extinguished before it was

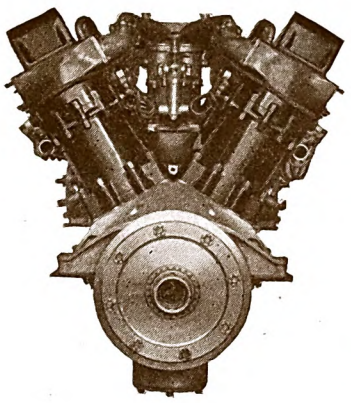
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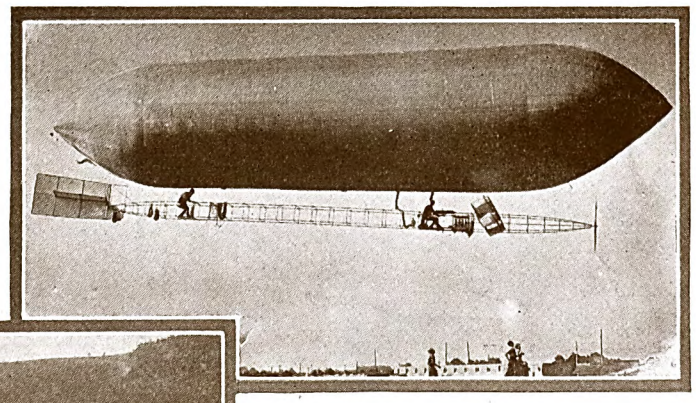


GLENN HAMMOND CURTISS

Faster, faster and ever faster, is the insatiable urge of his genius. Speed, distance, altitude—wheels, boats, wings—land, sea and sky—this twentieth-century, American Caesar has added their domains to the empire of man. He is still a young man, yet in less than half his lifetime he has quadrupled the speed of actual travel.

"Hitting on all twelve," this 400 h. p. Curtiss motor made possible the incredible speed record of the Curtiss-Army racing 'plane. Its weight is only 1¾ pounds per horsepower.



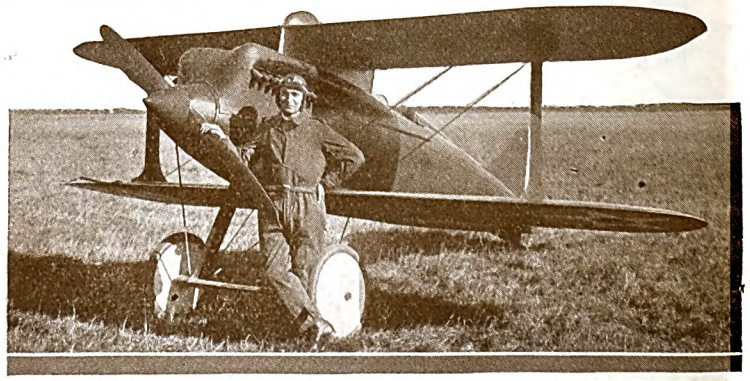


Curtiss made his first aeronautical motors for Captain Baldwin's dirigible balloon in 1905 and had his first taste of aerial flight in that manner. In the illustration at the left Curtiss is "forward" and Baldwin "aft."



Mr. Curtiss won the Scientific American trophy on July 4, 1908, by flying his first machine, "The June Bug," one kilometer straightaway under its own power. The first public flight in America.

He doesn't look it, but Lieut. R. L. Maughan, U. S. A., has just led, for a few minutes, the fastest life any man ever lived, 249 miles an hour at Detroit, September 25, 1922. Had he been fired from a cannon in Civil War days he would have traveled only twice as fast.



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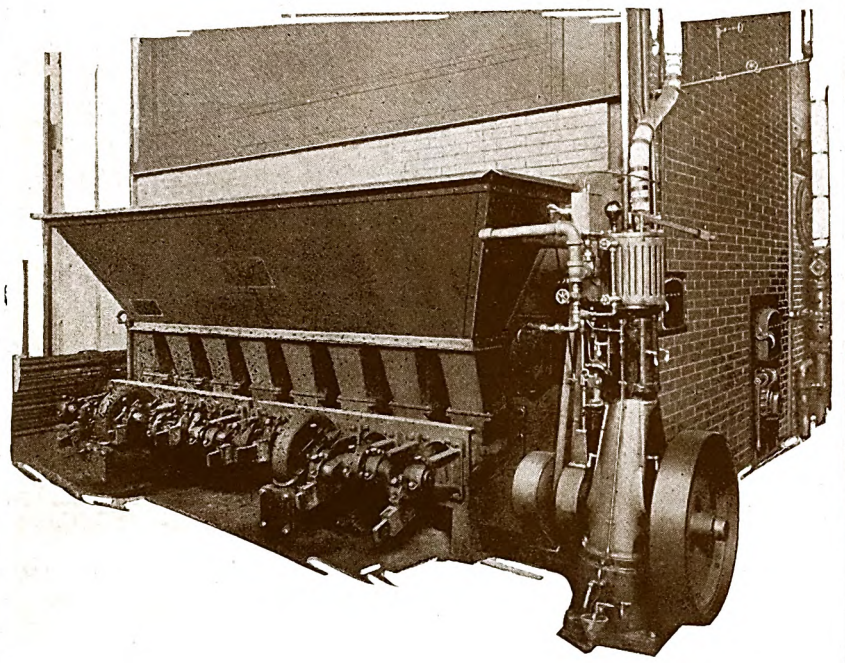
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For continuous service, year in and year out, you can absolutely depend on the Troy steam engine. This rugged little engine keeps running faithfully over long periods. It carries the load with a regularity that is almost uncanny. In fact, in stoker operation, about the only time, you'll ever see one down is when they are cleaning the boiler, except of course, when packing is required.

Carefully balanced for smooth operation and minimum wear these dependable Troy engines are unexcelled for economy and close regulation.

Troy steam engines are used in the best plants for driving generators, exciters, stokers, blowers, fans and pumps, and are used in capacity up to 200 horsepower, in both horizontal and vertical type. They are built by specialists to meet your exact conditions. Our engineers will be pleased to consult with you.

Write for the Troy Catalog

TROY ENGINE & MACHINE CO.,
TROY, PENNSYLVANIA

Ford Foundry Practice at River Rouge

(*Continued from page 14*)

is necessary to trace them through step by step to learn what it is all about. Before we do this, however, just one word more about transportation as the key-note of foundry operation. In the ordinary foundry molds stand still and men take steps. It is true that in the usual foundry the molten metal must be transported to the molds and that the castings, after they are made, must be taken from the molding floors to the cleaning room, and thence to the machine shop, but the journey is by no means a continuous one. In the average foundry transportation is incidental rather than a key-note. The result of this is that one usually finds *departmentalization,* the presence of distinct and segregated core rooms, molding floors and cleaning rooms that have little in common.

At River Rouge with its key-note of transportation, departmentalization is subdued in spite of the fact that specialization is brought to its highest terms. The process is considered as a whole, starting with the core making, on through the molding, pouring, shaking out and the cleaning of castings. It becomes a *continuous process* instead of a disjointed succession of independent processes, a process knit together from start to finish by practically continuous conveyor transportation. This is true both for the heavy and light castings, and to understand the River Rouge methods one must leave the cupola line and its spectacular streams of flowing metal, go back to the embryo of all, the core, and follow this to the conclusion—to the finished, cleaned and glistening casting delivered at the machining department. For casting machining at River Rouge is considered a part of casting making, housed in the same building with core making, molding and cleaning activities and intimately connected therewith by conveyor transportation.

As typical of all other major operations at this foundry, let us follow the evolution of a Ford motor or tractor cylinder from core to clean casting. To do this we shall have to walk away from the cupola front down past one of the three-hundred-foot heavy mold systems, past the shakeout stations where the return molds are broken open and finally to the core making and baking stations.

Picture to yourself a double line of square core ramming tables surmounted by overhead sand galleries with core sand delivery spouts leading down to each table. Here the cores are rammed in metal boxes, placed on adjacent finishing tables, slicked and smoothed and wired by specialists who do nothing else and then placed on the suspended shelves of the pendulum conveyor which carries the finished cores away to be baked. Perhaps it is a cylinder body core which must be sprayed with core wash. If so, at the end of its conveyor journey the green core is lifted into a spray hood—a turntable affair divided into quadrants. Here it is sprayed with core wash by means of a compressed air spray gun. Next it is lifted and placed upon the shelf of one of the moving iron cabinets which travel continuously through the core ovens. A two-hour journey through one of these ovens subjected to the heat of gas produced at the Ford coke ovens, completely bakes the core. It is ready for the mold and goes to the molding systems on long apron conveyors.

To follow the operations in molding, we must start on one of the two outer lines of the heavy molding system at the opposite end from the cupola, and close to where our inspection of core making has terminated. As we look down one of these lines we see a line of molding machines, two batteries of six machines, each of the machines being spaced ten or twelve feet apart. The line of molding machies is parallel to the conveyor molding line and perhaps eight feet to one side of it. Over the top of the molding machines extends a sand gallery with its pendant spouts

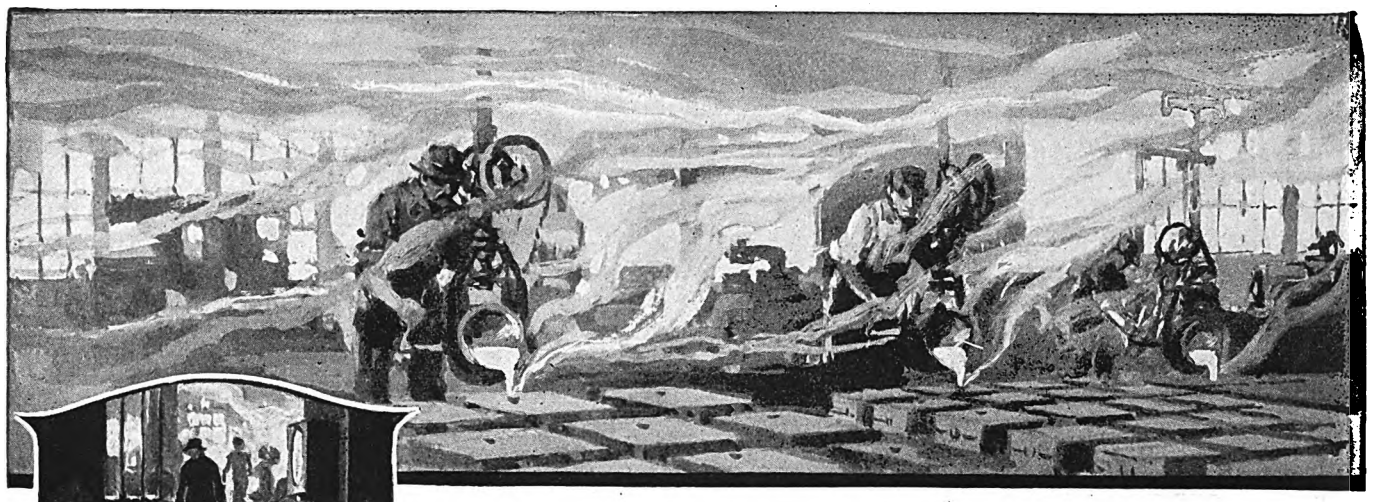
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leading immediately to each machine and so arranged that a pull will deliver sand directly into the flask.

The six molding machines at the origin of the conveyor system are used for ramming the drags or lower halves of the cylinder molds. Three men man each machine, ramming and setting gaggers and venting and slicking the half molds. As each half mold is finished it is lifted and placed upon the conveyor system to begin its journey toward the pouring station near the cupola. As it proceeds it passes various operators, each having a highly specialized duty. One of them places the housing core in position, another the port core, another the water jacket core and so on. One operator applies a templet to the core setting to make sure that the work has been properly done, another one sets the chaplets and another one tallies the drags. Each man has his special operation to perform and does nothing else. As a result the mold grows with marvelous rapidity.

By the time these operations have been performed, the steadily moving conveyor has brought the mold opposite the second battery of molding machines on which the copes or upper halves of the mold have been formed. Here also are three men to a battery and here the cope after being slicked and finished is inverted and placed upon the drag with its nest of cores. There remain now but a few more operations, such as placing the flask pins, clamping, wedging, ramming the runner boxes and backplates, each of which is progressively completed. By this time the last operation is finished and the mold has reached the pouring station where one-ton hot metal ladles, suspended from loops in the monorail system, spill their contents into the waiting sand cavity.

Thus the mold comes to the end of its up-journey. It is next slid over a transverse roller conveyor to the center or return track which runs between the two active outer lines and at twice their speed, thus caring for the output of both outer conveyors. On this return line, the poured molds travel under an exhaust hood which carries away their smoke and fumes and which surround the molds with cool fresh air. After some two hundred feet of this return journey has been completed, the casting has solidified sufficiently so that the runner block may be knocked off and pitchforked into a waiting back stock car. Twenty or thirty feet further an operator with a long iron bar lifts off the cope or top half of the flask, dumping it upon one of the shakeout gratings. The drag or lower half containing the red hot but solidified casting proceeds a bit further. Then a burly workman wearing a gas mask and armed with a sort of ice-tongs, seizes the red hot cylin-

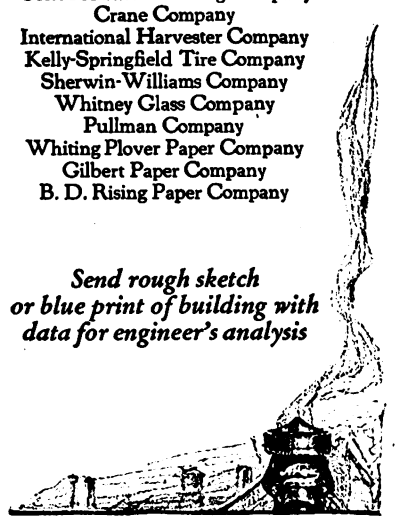




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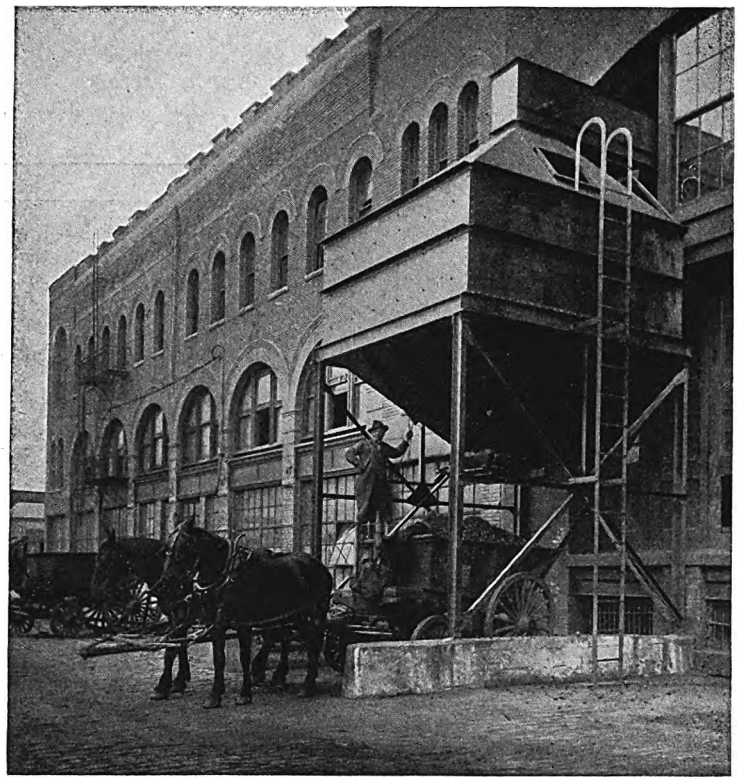
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Ashes that are automatically conveyed direct from the pits to wagon, truck or pile are handled speedily, efficiently—without the expenditure of a single cent in labor.

If you are still handling your ashes by the old hand method we would like to look over your plant and show you just how a G-W Ash Handling Equipment could save money for you. This equipment is made in many types and can be adapted to practically every ash handling situation.

A G-W representative will gladly bring complete information to your office or we shall be pleased to mail our descriptive catalog on request.

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The Gifford-Wood Company specializes in elevating and conveying machinery for all lines of industry, including coal pockets, (wood, steel, concrete; rectangular, silo,) screens, hoppers, elevating and conveying equipment for ashes, stone, sand, gravel; pivoted bucket carriers, warehouse conveyors, portable belt conveyors, wagon loaders, car unloaders, friction clutches, hoists.

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der, lifts it by means of an overhead block and tackle, and swings it with skillful movement directly into one of the compartments of the hot casting conveyor which leads to the cleaning room mezzanine.

The sand from the cope and drag halves of each flask is dumped on the shakeout gratings. It falls through these gratings and down upon a conveyor that is located underneath the floor, and which carries this sand first to the sifting screens and next to the cutting machine, where some ninety percent of it is reclaimed. From these machines it goes via automatic transportation to the sand gallery thence to the molding machines, by way of the pendant sand spouts, repeating this cycle over and over again.

The hot casting conveyor carries its burden of glowing castings from the ground floor level to the cleaning mezzanine. As the castings arrive on the mezzanine, they are swung from the conveyor into cooling racks, each of which holds from thirty to forty cylinders. Here they cool some four hours. Racks which have become cool are picked up bodily by an overhead travelling crane, carried down the cooling bay and into a transverse runway, dropped upon lift trucks and hauled by tractor to the core sand cleaning stations, also on the mezzanine but in adjoining bays. Here the heavy chipping operations are performed by means of air hammers and the core sand is knocked out through a grating somewhat similar to that at the mold shakeout stations. The core sand falls upon a conveyor belt, passes through a magnetic separator which relieves it of wire and iron, goes to screening, cutting and mixing machines, and receives the necessary addition of new material, after which it is wheeled by truck along the core sand galleries over the ramming tables, to be used over again.

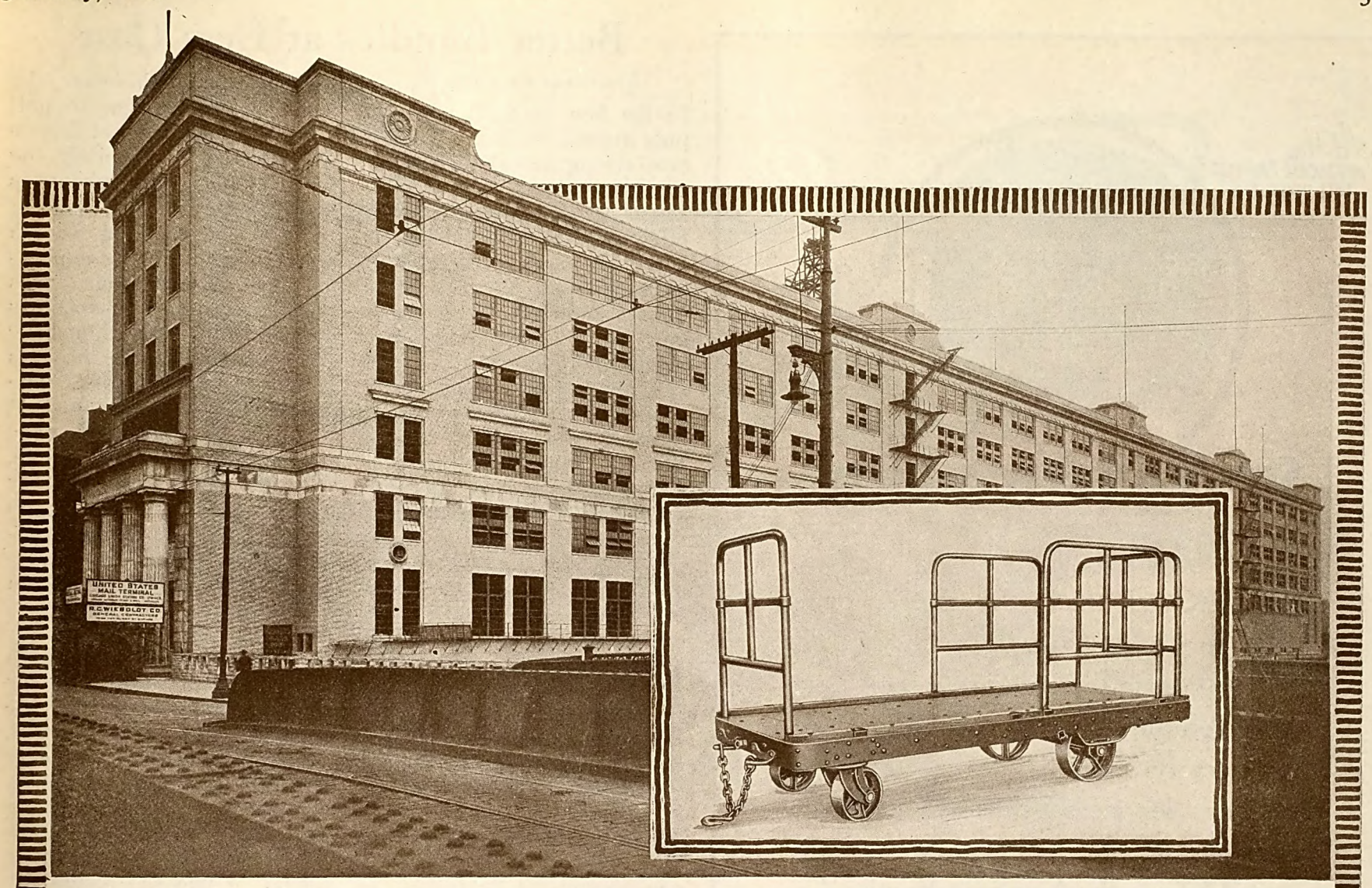
Leading down from the mezzanine are a number of very unusual and interesting conveyors, the links of which resemble somewhat the seats of swivel chairs, but which, in fact, are especially designed to receive the cylinders or tractor transmission frames that it is their duty to carry down to the tumbling barrels below the mezzanine. There are hundreds of these barrels at River Rouge, one hundred and ninety-two of them alone for the heavy castings, for the entire product of the foundry is tumbled. Each "swivel chair" conveyor leads past and around several units of tumbling barrels, eight barrels to a unit, feeding them and also carrying away their output. They carry the tumbled castings to the final apron flight conveyor adjacent to the machining department and, then their duty performed, make a return bend and climb back upwards to the mezzanine for a fresh load.

On the apron flight conveyor, the final operations of cleaning are performed. Here, too, the work is highly specialized, each man performing but one operation; it may be chipping a certain fin or testing the cylinder with a hammer for cracks. Finally, the last operation performed, the cylinder is led to the pile of castings "spotted" and ready for machining, which, by the way, is not a part of *this* story.

So much for the making of the Ford cylinders which is typical of all the rest of the operations at the River Rouge foundry. The light castings, of course, do not entail such a complex process but follow the same general line, starting with the cores, proceeding toward the cupolas, coming back again to the shakeout stations, then being cleaned and carried by conveyor to that portion of the machine shop fitted to machine them.

Probably after all, the pictures will tell the story better than could words.

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The New Chicago Railway Mail Terminal uses more than a thousand K & J Trailer Trucks

On big installations, where carrying costs must be figured to the last notch—where the work to be done is so large that the effect of even very small shortcomings of equipment would be multiplied, through day in and day out service, into huge annual wastes—on installations such as this, "K & J" Trailer Equipment has demonstrated itself to be safest.

In this great, new Chicago Mail Terminal, over eleven hundred "K & J" Trailers and Trucks are being installed to meet the initial needs of this huge modern plant—a plant of national importance, designed for the quick, efficient handling of mails in this vital center of mail transportation.

The trailers, of the type shown, are of 4000 lbs. capacity, having a 36"x84" platform. Rear Wheels have individual axles.

These trailers are equipped with Hyatt Roller Bearings, with ball bearing caster swivels.

The experience developed by the "K & J" Organization, in meeting the exacting needs of such large installations through many years of truck and trailer building is, ample assurance of its unrivalled fitness for taking care of all classes of truck and trailer requirements, either large or small.

Write for Bulletin 510.

TRADE MARK

THE SEAL OF SATISFACTION K&J REG.

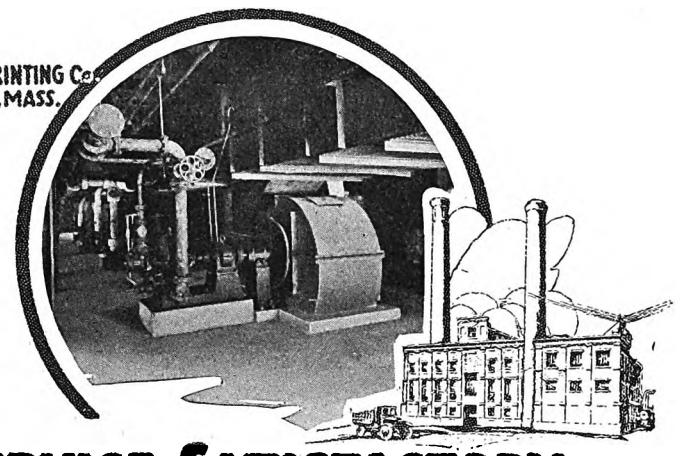
The Kilbourne & Jacobs Mfg. Co.

COLUMBUS, OHIO, U. S. A.

New York, 120 Broadway

Connections in all parts of the world.

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SERVICE SATISFACTORY

TALK with many experienced operators and you will find very little variety in the comments they have to offer on the behavior of Terry turbines. "Satisfactory Service," "perfectly satisfied" or "service satisfactory" seems to constitute the principal variety, and the comment from the American Printing Co. of Fall River, Mass., proves no exception to the rule. Though they have twenty turbines, some of which were installed as far back as 1916, the report shows "no shutdowns" and "service satisfactory." There are five turbines driving forced draft fans, one driving a duplex exciter four driving fuel oil pumps, five driving boiler feeders, and the balance are used for driving condenser auxiliaries and pumps for miscellaneous service. Let the comments of experienced engineers guide you, and for your next turbine requirement

Specify

T-798

THE TERRY TURBINE

Offices in Principal Cities in U.S.A. also in Important Industrial Foreign Countries

The Terry Steam Turbine Co. Terry Sq. Hartford, Conn. U.S.A.

Better Bundles at Less Cost

(*Continued from page 17*)

In the first place, it not only puts around the box a band of steel strong enough to keep the contents intact, even under rough handling which would otherwise split the boards or loosen the nails of a box not so reinforced, but permits a lighter and therefore cheaper box to be used. This also means the elimination of considerable dead shipment weight. In addition to tensile strength, which in the case of thirteen gauge wire is over 600 pounds, wire has other advantages: It cuts into the corners of the box, making it impossible to slip the band off, and when applied with the new machine the tie, consisting of three complete turns on each side or six twists in all, is stronger than the wire itself.

The machine is motor driven, both the tensioning of wire and the subsequent operations of twisting and cutting off being performed automatically. A box, for instance, is strapped with what is practically one continuous operation, as against a dozen or more different motions employed by other methods—fiddling with several different levers, hooks, ratchets, and so on, in order to apply one strap and get set for the next one. Moreover, the wire used for binding purposes does not have to be cut up into special lengths or otherwise specially prepared, but is drawn from the coil form, just as it comes from the mill.

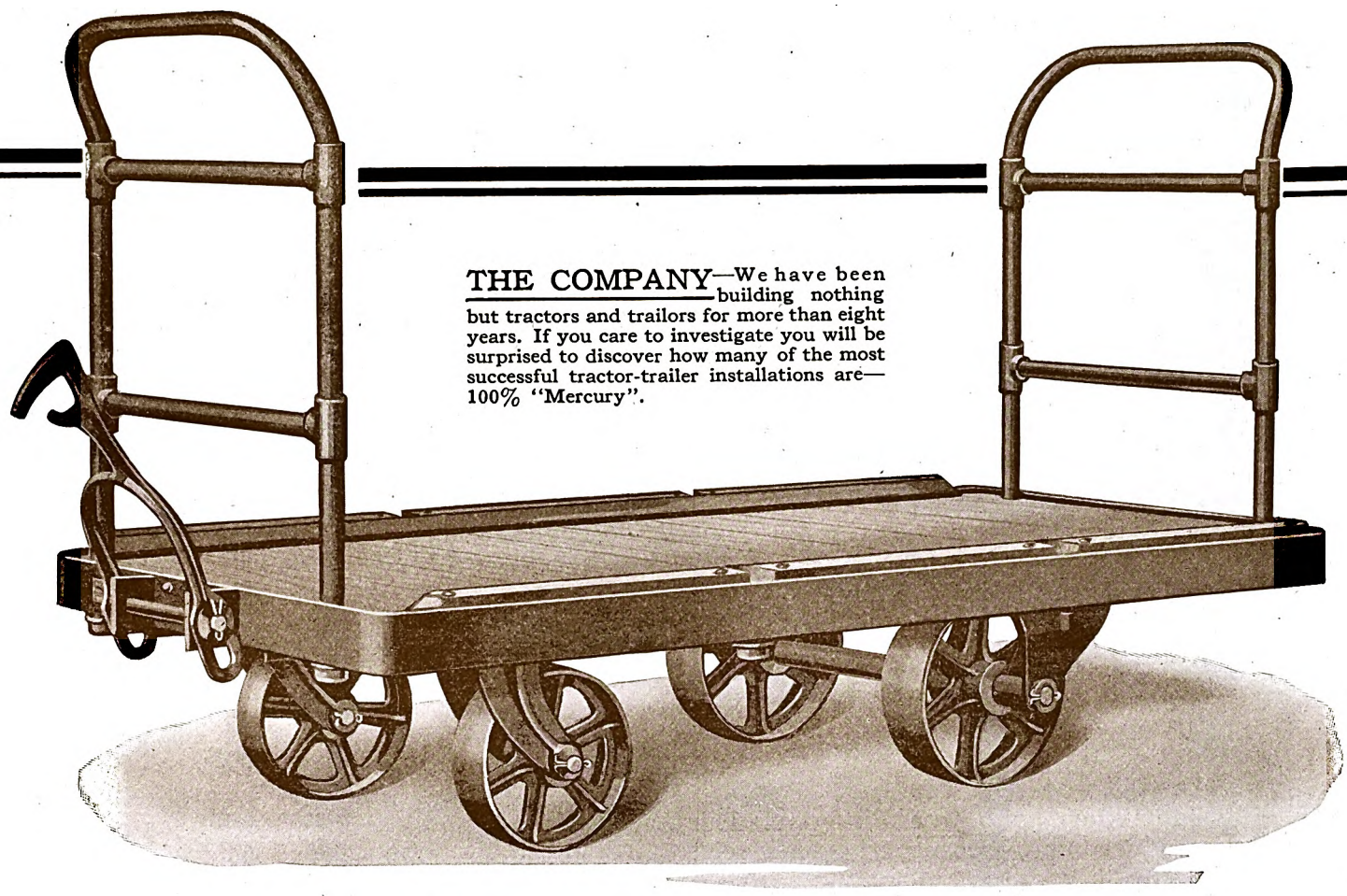
A notable feature of the machine is its simplicity, as anyone can operate it without previous training or long practice. The operator merely places the wire in position, presses the foot treadle which puts the bundle under heavy compression, and the same operation lowers the tying mechanism onto the surface of the package. The wire is then passed around the overhanging end of the article to be tied and laid in the rotating tension drum, which immediately seizes it and draws it to the required tautness. The tension is necessarily adjustable, because a tension that a fragile container could not stand might be very desirable on a large, heavy box carrying heavy, bulky goods. Once the tension is determined and set by the operator, however, the machine will continue to pull each band to this exact degree of tightness indefinitely or until another adjustment is made.

When the required tension is reached in binding a package, the tension drum stops and the twisting mechanism is automatically engaged, making the tie and cutting off the ends in a fraction of a second. The ends are cut off close and at the same time turned towards the surface of the box. Thus, with the ends down entirely out of the way there is no chance for injury to the handlers of the packages and nothing to interfere with their even piling. Rigid back stops and side stops are provided for forming a corner into which loose pieces of board, shingles or similar material may be quickly and evenly stacked. These stops may be quickly moved by loosening two clamping screws with large wing nuts, while the machine is adjusted for height, when a change of package occurs, by the simple manipulation of two hand wheels on the over-arm.

Because of its rapid operation and convenience of handling the work, the machine saves time and reduces the labor item in tying costs very materially; the user pays for the machine but once, while labor must be paid for every hour. The cost of any article is, of course, the cost of using it. Wire is the cheapest tying material obtainable, costing now only about half as much per foot as common sisal or lath yarn. With this machine wire is used in its cheapest form directly from the coil, thus eliminating the waste and saving the expense of using specially prepared, cut-to-length, looped, knotted, twisted or notched pieces.

These machines may be used with any wire from 12 to 20 gauge. They will use Nos. 12, 13, and 14, or Nos. 15, 16, and 17, or Nos. 18, 19, and 20, without the necessity of making any changes whatever on the machine. This means that although a big strong wire may be required for large, heavy bundles, one can without loss of time change to a small gauge wire, giving many more feet to the pound, for small, light shipments.

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THE COMPANY—We have been building nothing but tractors and trailors for more than eight years. If you care to investigate you will be surprised to discover how many of the most successful tractor-trailer installations are—100% "Mercury".

Announcing "The Trackless Train" Trailer

TYPE A-310

A CASTOR TYPE industrial trailer used by freight stations, marine terminals, warehouses, industrial plants, and suitable for any other work requiring a staunch, easy-running, well designed vehicle of this kind.

This trailer is the product of the experience of the pioneer, specialized trailer engineering talent, and complete manufacturing facilities. There is not a single feature incorporated in the design that has not been thoroughly tried and tested by the relentless ordeal of actual service. We believe the A-310 to be the best all-purpose industrial trailer on the market. You will want to know more about this splendid vehicle.

Write for Trailer Bulletin A-100

Mercury Manufacturing Company

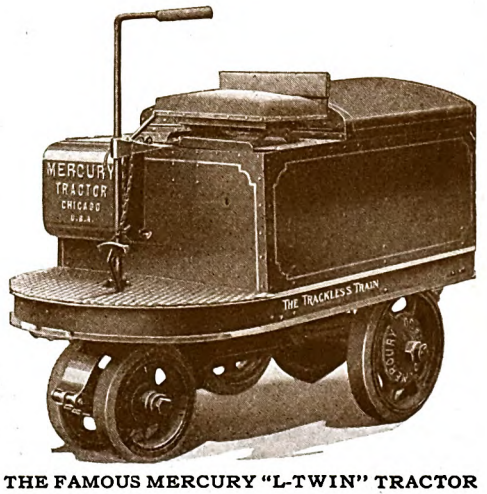
4118 South Halsted Street ***Chicago, Ill.***

A FEW OF THE MANY SATISFIED USERS OF MERCURY TRAILERS

STUDEBAKER CORPORATION .....South Bend, Ind.
BIRD & SON, INC.....Chicago, Ill.
KANSAS CITY COLD STORAGE Co....Kansas City, Mo.
PACIFIC MILLS.....Lawrence, Mass.
GENERAL ELECTRIC CO.....Pittsfield, Mass.
SEARS-ROEBUCK & CO.....Philadelphia, Pa.
C. B. & Q. RAILROAD.....Chicago, Ill.
PENNSYLVANIA RAILROAD.....Chicago, Ill.
REO MOTOR CAR CO.....Lansing, Mich.
SOUTHERN RAILROAD.....Pinners Point, Va.
NORTHWESTERN TERMINAL CO...Minneapolis, Minn.
BOSTON & ALBANY RAILROAD.....Boston, Mass.
BUTLER BROTHERS.....Chicago, Ill.
CHICAGO & ALTON RAILROAD.....Chicago, Ill.
NEW YORK CENTRAL RAILROAD.....Chicago, Ill.
SUGIMURA WAREHOUSE CORP.....Osaka, Japan

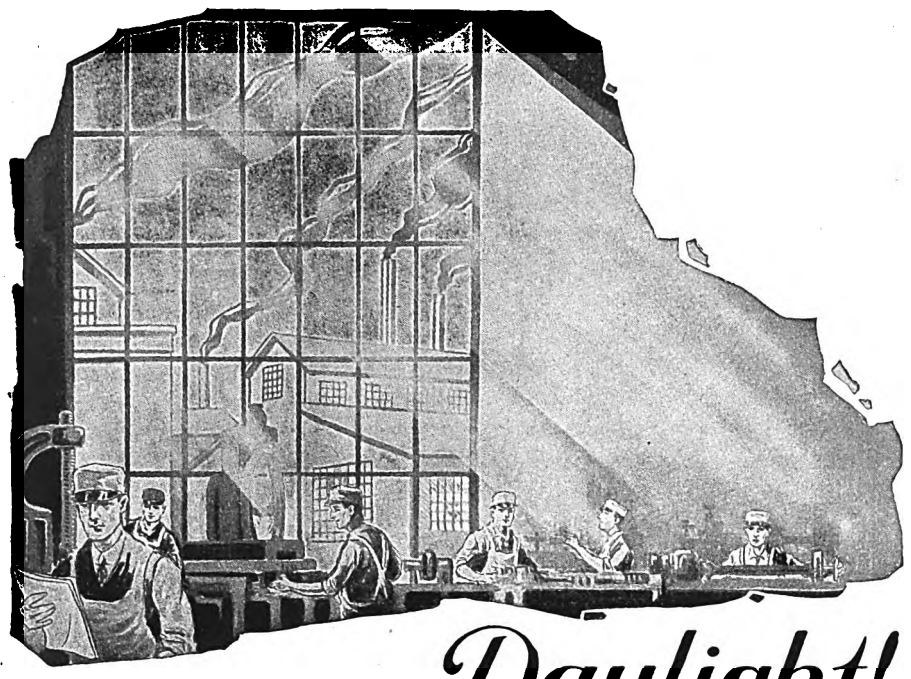
—and to pull the trailer —There is the Mercury Tractor offered in five distinct types and fifteen different models. (But that is a story in itself.) Write for Tractor Bulletin 103

CLYDE STEAMSHIP CO.....Charleston, S. C.
DALLAS BRASS & COPPER CO.....Chicago, Ill.
GREENVILLE COMPRESS CO.....Greenville, Texas
MEMPHIS TERMINAL CORP.....Memphis, Tenn.
WHITIN MACHINE WORKS.....Whitinsville, Mass.
WILSON & COMPANY.....Oklahoma City, Okla.
HAYNES AUTOMOBILE CO.....Kokomo, Ind.
LEHON COMPANY.....Chicago, Ill.
LEVER BROS. LTD.....Toronto, Can.
LYCOMING MOTORS CORP.....Williamsport, Pa.
MICHIGAN CENTRAL RAILROAD.....Detroit, Mich.
NORFOLK & WESTERN RAILROAD .....Roanoke, Va.
OLD DOMINION STEAMSHIP CO - New York City, N. Y.
OWENS BOTTLE COMPANY.....Charleston, W. Va.
COMPANIA TERMINAL ATARES.....Havana, Cuba



THE FAMOUS MERCURY "L-TWIN" TRACTOR

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Daylight!
Still the Best Factory Light

Daylight is still the best possible light—men who work in daylight produce more because they can see better.

SURLIGHT is a pure white interior paint which reflects practically all of the light that strikes the surface it covers. The soft rays of daylight diffused by this pure white paint will bring both work and machines into better, clearer relief—men can work faster when they are not under the tiring strain of poor and insufficient light. Spoilage is reduced, especially on precision work, because men more easily work to close gauges.

There is no glare to SURLIGHT—it does not blind or dazzle, but reflects daylight in soft, diffused rays that are restful as well as brightening. SURLIGHT is pure white and remains pure white during long years of service. It may be readily washed and its original tone and brilliance restored.

Sold in quantities direct to large corporation users only. Send for our De-Luxe SURLIGHT Book, a full treatise on the possibilities of this wonderful paint.

ST. LOUIS SURFACER & PAINT CO.
4202 Arlington Ave. St. Louis, Mo.

SURPACO — PAINTS FOR ALL INDUSTRIAL PURPOSES
Trade-Mark

A Few Surpaco Products
Metalsteel (for all exposed metal), Surnamel (white), Surlac (shellac substitute), Surfspar (water-proof varnish), Surlino (linseed oil substitute), Building Paints and Varnishes

Special for Railroads
(Steam and Electric)
Metalsteel (for all exposed metal), Locomotive and Cab Enamel, Canvas Preserver, Canvas Roof Paint, Car Enamel, Car Floor Paint, Car Surfacer, Coach and Locomotive Varnish, Pole Paint (steel and wood), Seat enamel (rattan), Seat Varnish (rattan), Station and Building Paint.

Paint All Interiors with

SURLIGHT

The Light Reflecting Wall Paint for Industrial Purposes

Ash Discharge on Underfeed Stokers

(*Continued from page 25*)

area that can be installed under the boiler. 500 or 600% of rating is not beyond the point of possibility, provided the boiler can be stokered up to that point. But it would probably by uneconomical from a good many points of view because so seldom required.

The same output, however, can be temporarily attained with a much smaller stoker if the operator feeds the coal in at a high rate, burning off the volatile and discharging a large proportion of the coke. Naturally this would be a very wasteful operation, but when the operator is confronted with the necessity of delivering a certain amount of steam or facing a shutdown, probably it would be the less wasteful course to pursue. Of course, this is an extreme case. A capable operator seldom gets caught in a jam which would require operation of that character. But he frequently finds himself under the necessity of increasing his steam delivery 50 to 100 % or more without warning. Under such circumstances he must put more coal through the stoker even though by doing so, he may lose a considerable amount of unburned carbon.

As has been said, the power dump is probably the most effective method of cleaning fires to accomplish this purpose. It provides a variable rate of ash discharge that functions at the will of the operator. It requires the minimum amount of time to drop the dump plate, so that the accumulation thereon may fall into the ash pit, and return the plate to its normal running position. A glance at the accompanying illustrations will show that it is easily possible to perform this operation in less than half a minute. The writer has studied a considerable number of steam flow meter charts of operation carried on at extremely high rates but with considerable fluctuation. It is especially noteworthy that in such operation there is practically no interruption to steaming as the result of the dumping period.

The power dump, therefore, provides the element which enables the operator to clean his fires quickly, easily and thoroughly, with absolute control over the dumping periods. Hence it is well established that for operation which involves considerable fluctuation, the power dump is the most desirable type of equipment for cleaning fires.

In the second class of operation the problem is entirely different. With a fairly constant load, the operator seeks, naturally, to operate his plant at the point of maximum efficiency. There is comparatively little need for the ability to clean fires instantly. Rather, there is urgent need for as nearly as possible, clean fires at all times. The ideal way to maintain clean fires is to discharge the ash as rapidly as it forms—in other words, by means of continuous ash discharge at a rate proportional to the rate of combustion.

The most practical and satisfactory device for accomplishing this result is the rotary ash discharge which has been brought to a high state of perfection.

The various illustrations in this article will indicate that one of the essential features of the rotary ash discharge is a deep ash pocket. This pocket must not be regarded as primarily a storage place for ash. If that were the only requirement, an ash pit would probably answer the purpose.

It is extremely difficult to handle hot ash. After the ash has become cool, it can readily be broken up and discharged. The ash pocket serves as a space in which ash may be treated or conditioned for discharging. The conditioning of the ash involves the final burning out of any combustible which it may contain after it leaves the stoker proper, and the cooling of the refuse.

To provide for this the ash pocket is divided horizontally into two sections. The upper section is flanked by a grate somewhat similar to the extension grate of the stoker itself. This is known as the lower extension grate. It is provided with ports through which air

(*Continued on page 37*)

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NORDBERG-CAREL'S DIESEL OIL ENGINES

BURN LOW GRADE FUEL OIL

Nordberg Two-Cycle Diesel Engines show remarkable economy over any other prime mover. The Nordberg Co. has installed upward of 38,000 horsepower, operating with the lowest grade of fuel oil, which can be handled successfully only with the two-cycle engine.

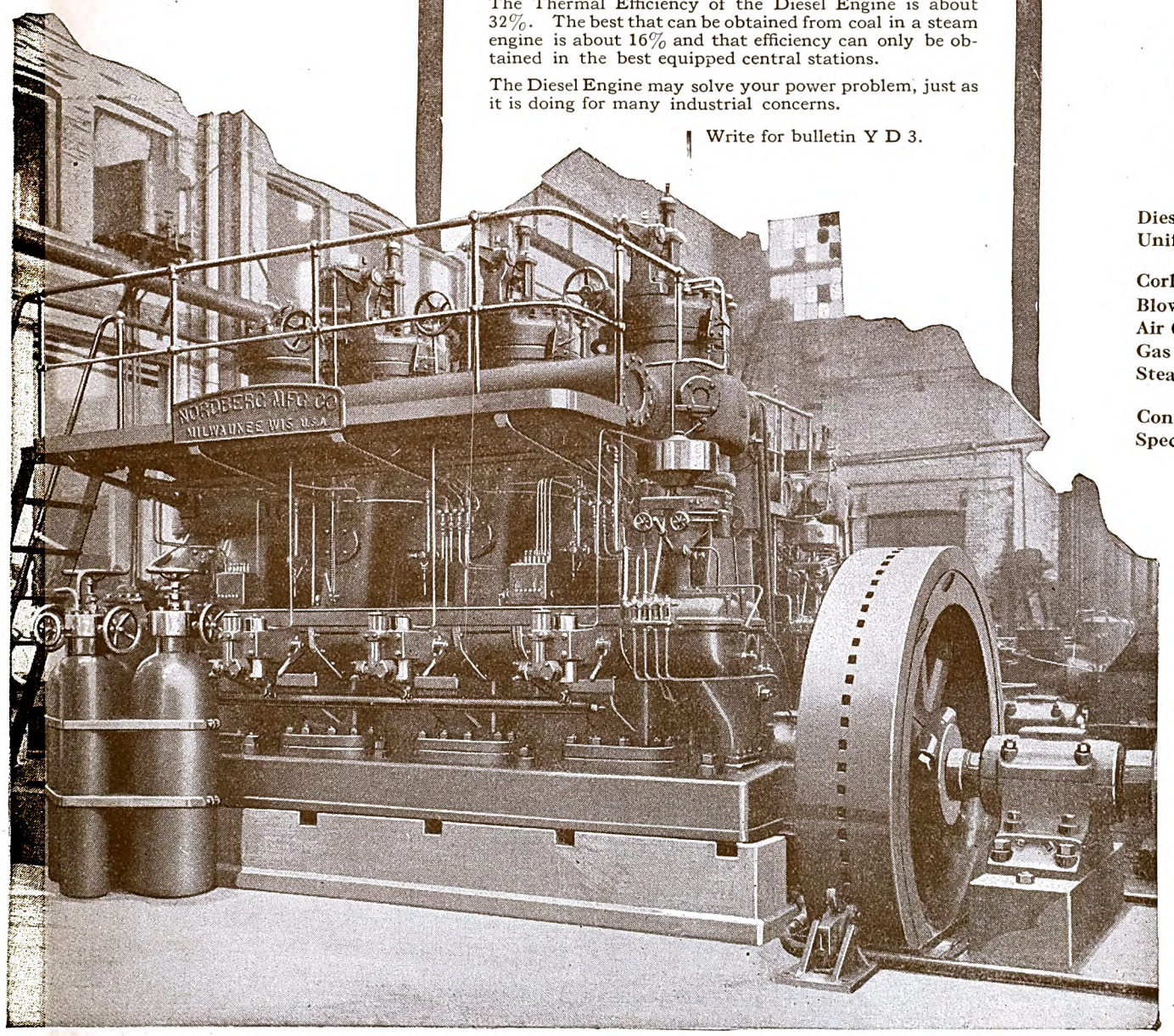
Nordberg Diesel Engines are used to drive the following diversified types of machinery:

Electric Generators
Air Compressors
Centrifugal Pumps
Plunger Pumps
Ice Machines
Line Shafting

The Thermal Efficiency of the Diesel Engine is about 32%. The best that can be obtained from coal in a steam engine is about 16% and that efficiency can only be obtained in the best equipped central stations.

The Diesel Engine may solve your power problem, just as it is doing for many industrial concerns.

Write for bulletin Y D 3.



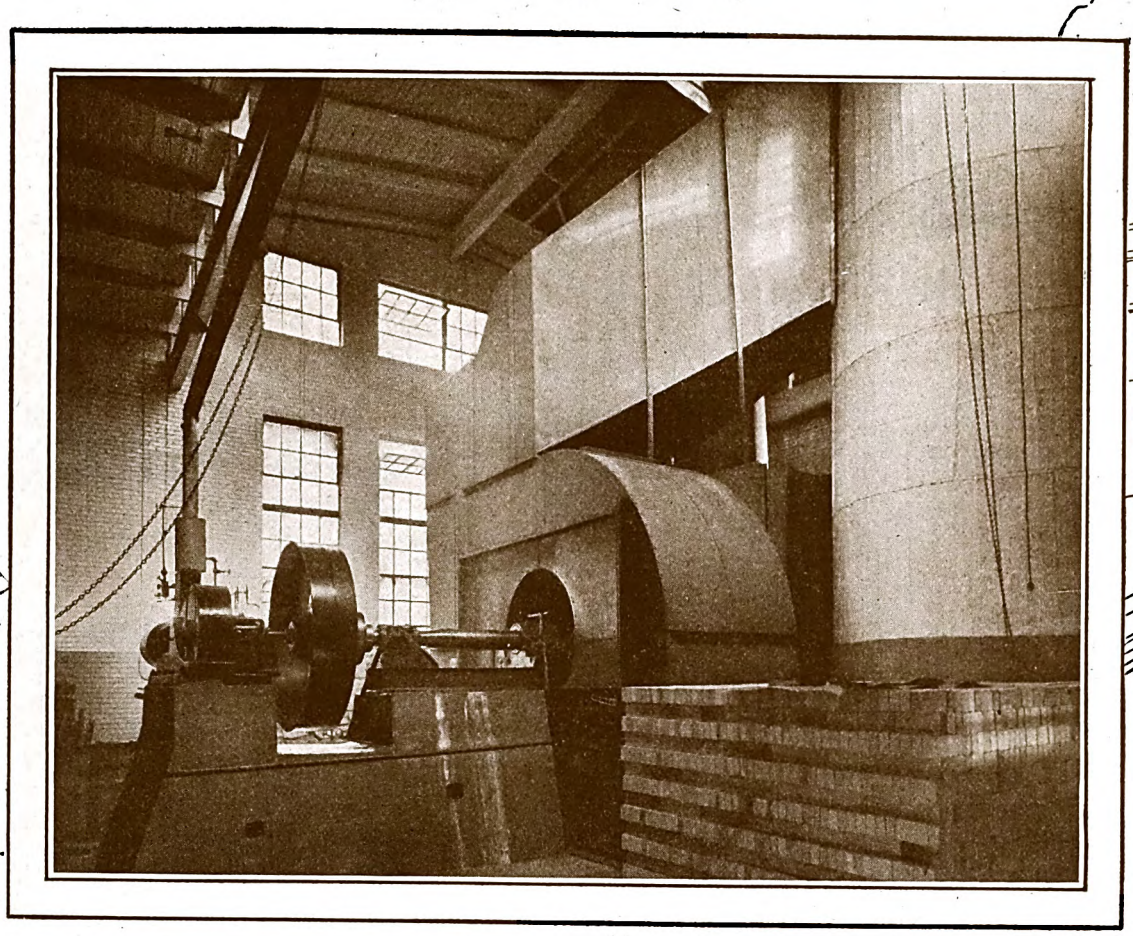
NORDBERG
MACHINERY

Diesel Engines,
Uniflow-Poppet Valve Engines,
Corliss Engines,
Blowing Engines,
Air Compressors,
Gas Compressors,
Steam, Air and Electric Mine Hoists,
Condensers,
Special Machinery.

NORDBERG MANUFACTURING CO.

MILWAUKEE WISCONSIN

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American Blower induced draft system in the plant of the Michigan Carton Company, Battle Creek, Mich.

Induced Draft System Makes Possible a Saving of Thousands of Dollars— Cheaper Coal is Burned

Ample power, though cheaper, poorer grades of coal are burned, and a most noticeable reduction in the cost of arch and boiler tube repairs are a certainty in power plants where American Blower Induced Draft Systems are in operation.

Frequently the saving effected totals thousands of dollars each year.

Evidence of huge savings come to us from power plants in all sections of the country where American Blower Induced Draft has replaced ordinary methods.

The following statement by W. I. Fell, President of the Michigan Carton Company, Battle Creek, Michigan, is typical:

"When we could burn only the better grades of coal, fuel shortages frequently forced us to stop half our cardboard machines and lose 40 or 50 tons production per day.

"Eighteen months ago we installed the American Blower Induced Draft System and saved many thousands of dollars lost through such production tie-ups because it enabled us to get ample power with poorer, cheaper coal without any difficulty.

"Formerly, even when we had the coal, our seven boilers (of 25,000 total horsepower) had to be forced very hard and 'bottled heat' resulted in arch repairs costing some $2,400 a year and tube repairs of $800 more.

"The American Blower System cut our arch repairs 75% and tube repairs 90%—thus saving us enough in repairs alone to pay its total operating cost, including interest, depreciation and power.

"In 24 hour service, 6 days a week, for a year and a half it has given us great satisfaction and required no attention but lubrication.

"With this equipment we get higher efficiency out of our coal, develop more power, save thousands in costly shutdowns and avoid $2,500 of troublesome arch and tube repairs."

Write today for our latest bulletin describing American Blower draft equipment, both forced and induced.

AMERICAN BLOWER COMPANY, DETROIT
BRANCHES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

199)

American Blower

"Sirocco" TRADE MARK

EXHAUSTERS · VENTILATING FANS · AIR WASHERS · BLOWERS · ENGINES

FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

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(*Continued from page 34*)

may be admitted in any desired quantity. The combustible which remains in the ash after it reaches the pocket continues to burn while in this section and until it passes below the bottom of the lower extension grate. This results in reducing to a minimum the combustible in the final residue and, therefore, in increased combustion efficiency.

The lower portion of the pocket is flanked by cast iron plates known as crusher plates. These provide a surface against which the clinker can be crushed. In all double set arrangements of the stoker there are crusher plates on each side of the pocket. This is also true of single set arrangements where two crusher rolls are provided. When only one crusher roll is used, the crusher plate is on the stoker side of the pocket and the bridge wall side is lined with a rigid cast iron plate.

The crusher plate is movable so that the gap between the plate and the roll may be adjusted to any desired width. This provides for crushing the clinker to any size suitable for easy handling by any ash disposal system. It also permits a certain degree of variation in the rate of ash discharge although this is a secondary function. Finally, it provides a means whereby the ash pocket may be emptied when the stoker is off the line for cleaning or overhauling. The accompanying illustration of one of the furnaces at the Syracuse plant of Solvay Process Company shows one section of the crusher plate in running position, while the other sections are wide open.

The crusher rolls are the operating element of this system of ash discharge. They consist of cast iron shells mounted on a steel shaft which has a square cross section. The shells are built up in sections for convenience and are armed with teeth that have a triangular cross section. These teeth are made of special cast iron which is very durable and are made removable for ready replacement. The design of the teeth is such as to provide the maximum crushing force with the least strain on the rolls or mechanism.

The rolls may be operated by the stoker drive or independently as desired. In either case provision is made for varying the speed of the rolls independently of the stoker so that the operator may regulate the proportionate rate of ash discharge. In all two-roll arrangements, the rolls are made to rotate away from each other at the top, while in the single roll arrangement, the roll rotates toward the stoker.

The advantages of the rotary ash discharge system are:

First: It provides a space in which combustible may be consumed to the ultimate degree,

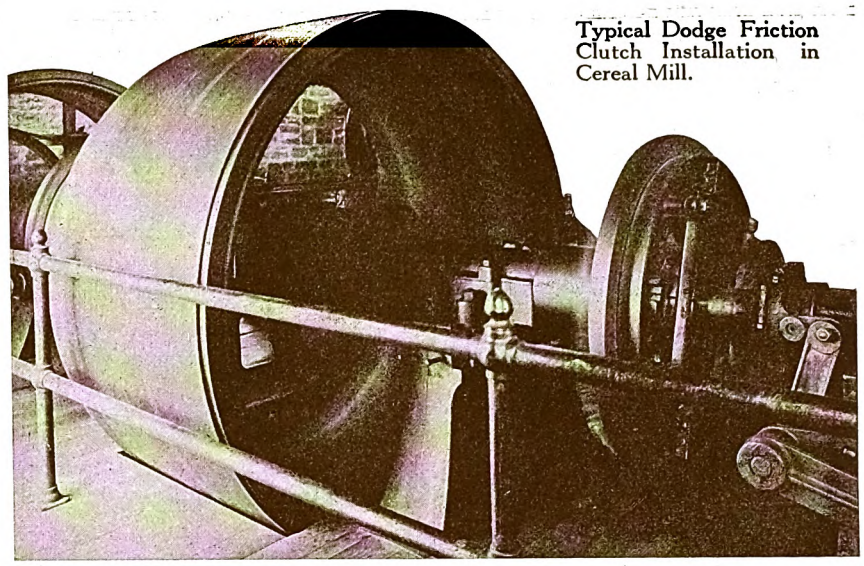
Second: It provides a space in which the ash may be cooled,

Third: It provides a means whereby the ash and clinker may be continuously crushed and discharged, and

Fourth: It insures practically constant furnace conditions.

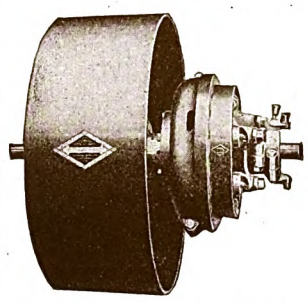
Approximately 300,000 rated boiler horsepower has been equipped with stokers using this rotary ash discharge system. The operation of these plants has been closely watched and frequent reports have been received as to the results obtained. Not the least important result is that with this system, stoker operation is reduced practically to supervision alone.

A good many well authenticated cases are on record in which the increase amounts to two or three percent or more. The average amount of combustible in the refuse amounts to less than ten percent. And the ability to burn out fuel to so great a degree naturally results in a considerable saving in that direction.



Typical Dodge Friction Clutch Installation in Cereal Mill.

How Much of Your Power is Driving Idle Machinery?



Dodge Split Friction Clutch with Dodge Split Iron Pulley mounted on sleeve.

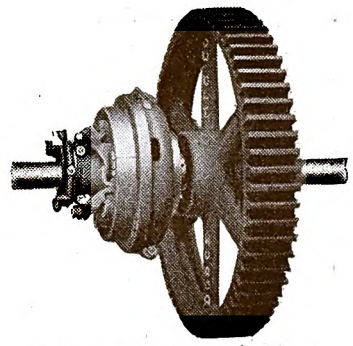
If you are now paying for power that is not doing productive work—if your entire plant or any department is at the mercy of one machine breakdowns, you cannot afford to ignore the advantages of a Dodge friction clutch installation.

A department, lineshaft, countershaft or individual machine may be instantly cut out from any other part of your power transmission system and your losses due to idle men and interrupted production reduced to a minimum.

The value of individual control of machines, groups and departments in the saving of power, time and expense is best appreciated by the executive who has witnessed a complete shutdown, men idle and production stopped because of an accident to belt pulley or shaft.

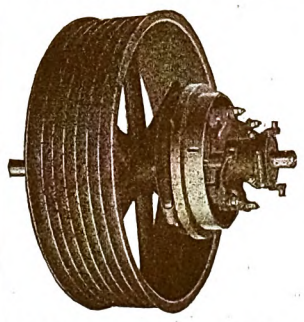
The cost of one such accident will pay for a Dodge friction clutch installation and the savings effected will prove that these clutches are the most consistent dividend payers in your plant.

Thousands of Dodge clutches have paid for themselves during their first year of operation—thousands of satisfactory installations in all industries back your judgment when you specify them for your factory.



Dodge Split Friction Clutch with Dodge Spur Gear mounted on sleeve.

Dodge friction clutches, as well as pulleys, hangers, bearings, pillow blocks, collars, couplings, etc., can be purchased from your local Dodge dealer on the immediate delivery basis.



Dodge Split Friction Clutch with Dodge Sheave mounted on sleeve.

Our special clutch bulletin gives full particulars—write for it.

DODGE

Power Transmission Machinery

Dodge Manufacturing Corporation

General Offices: Mishawaka, Indiana Works: Mishawaka, Indiana, and Oneida, N. Y.

Dodge Manufacturing Company of Canada, Ltd., Toronto and Montreal

New York, Boston, Philadelphia, Pittsburgh, Newark, Atlanta, Cincinnati, Minneapolis, Houston, Seattle, St. Louis, San Francisco, Chicago

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Is Tramp Iron a Menace in Your Coal Handling?

"Pennsylvania" Bradford Breakers and Hammer Crushers automatically and accurately sort out the tramp iron during the crushing operation, preventing damage to crushers, and stokers, without extra power or upkeep.

In addition, "Pennsylvania" Bradford Breakers automatically remove the harder impurities including, slate, bone, rock, sulphur balls and mine props, together with the tramp iron, while preparing Bituminous coal for Stokers, By-Product Coking, Gas Making and preliminary to pulverization for Powered Fuel Plants.

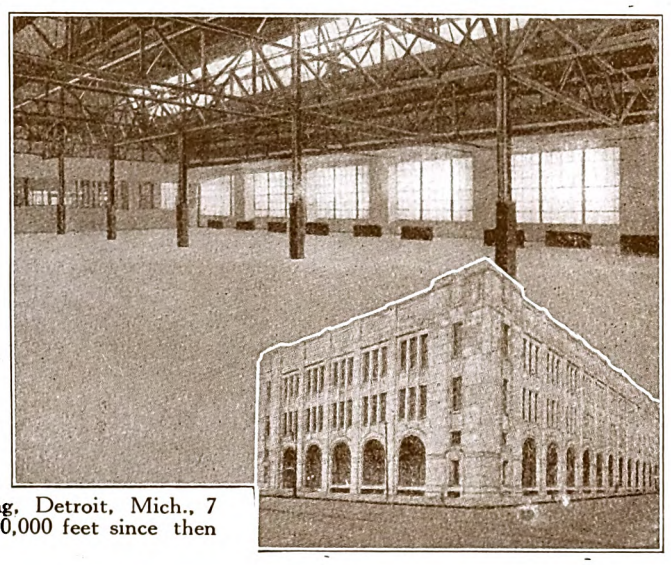
We have brought the right solution to many coal preparation problems, and are ready to cooperate on receipt of your suggestion.

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An Annihilator of Distance

(*Continued from Page 26*)

snatched up and passed on until, in the field before us at the moment, it was carried upward higher than Everest, unstopped across oceans, and again at four miles a minute. The very city of old Lisbon which with incredulity saw de Gusmao send a globe weighing but a few ounces to the ceiling with heated air, greeted with acclaim six men who came on wings out of the west in a 14-ton boat marked N for the Navy of a nation unborn in de Gusmao's time, and C for Curtiss, whose very ancestors had not yet left Europe for the new land, built in large part of materials, and driven by fuel and machinery, the eye of man had never seen. It was of such stuff as only dreams were made of, then.

All that has been said may be put inversely this way: the achievements of today have their roots in the past, each step in the conquest of nature grows on the imagination, the researches, the experiments, the developments of men who have gone before. Mostly it is by toilsome, short steps. Then once in a generation, or a century, or a millenium, there comes a man who in one leap covers more ground than all who have gone before him. Such a man is Glenn Hammond Curtiss.

The study of aeronautics was not born with Curtiss. No one can state more plainly than he his indebtedness to his forerunners all the way from the ancients to his contemporaries. But what otherwise was still scientific study, Curtiss' genius and skill advanced and converted into a practical device, enabling man to function in a new element, so thoroughly at will that, without the necessity of waiting for the slow processes of evolution to adapt him to the enlarged environment, already it has annihilated a large part of the physical limitations which have circumscribed man's contact with his world from the beginning. Curtiss works with appliances rather than problems, he thinks in terms of areoplanes instead of areonautics, he doesn't set his answer down on a piece of paper—he sets it up in the shop. That has been his characteristic since boyhood.

It was never mere tinkering, because he made things work. A couple of tomato cans in his hands became anything from an acetylene gas generator to a carburetor on a motor-cycle's engine. Steadily his experimental genius and mechanical skill were developed through years of handicraft, his business acumen through as many years of wresting a living from the world. His schooling ended with graduation from high school, with a practically perfect record in the final examinations. He would say his education is not ended yet. With his quest for knowledge, it never will be.

Curtiss' working days began in the Eastman kodak factory in Rochester where he took advantage of his surroundings to learn photography. Owing to the habits then formed, there is forunately photographic record of practically every event of interest in his development of the airplane. In his spare time he did odd jobs of many sorts which called for his mechanical turn of mind and hand. Among other things, he repaired bicycles. When his family moved back to Hammondsport, where Glenn was born on the 21st of May, 1878, he put this practice into good use by opening up a bicycle repair shop. He was then not quite twenty years of age. Probably it was at this time, if it is possible to fix a time, when the urge for speed, more and greater speed, seized upon Curtiss. He did some racing, but had not the physique of a winner.

But what he lacked in the legs he had in the brain. In 1901 his head was saving his heels by contriving a gasoline engine built with his own hands so small that he could fasten it to his wheel. The tomato cans figured in it. Ideas came "out of the air," as Wagner said his musical themes came. Standing one day, chatting with a friend, he was idly and absent-mindedly twisting the handle of his "bike." But the absent mind wasn't wool-gathering; suddenly it struck home with an idea—the handle control, familiar today in all motorcycles. Of course the "contraption" young Curtiss built had to be laughed at, and had

(*Continued on Page 40*)

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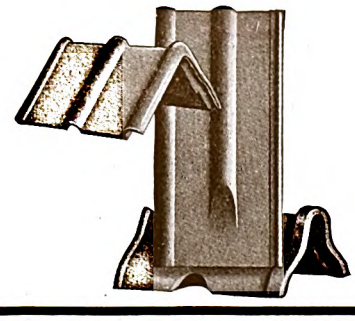
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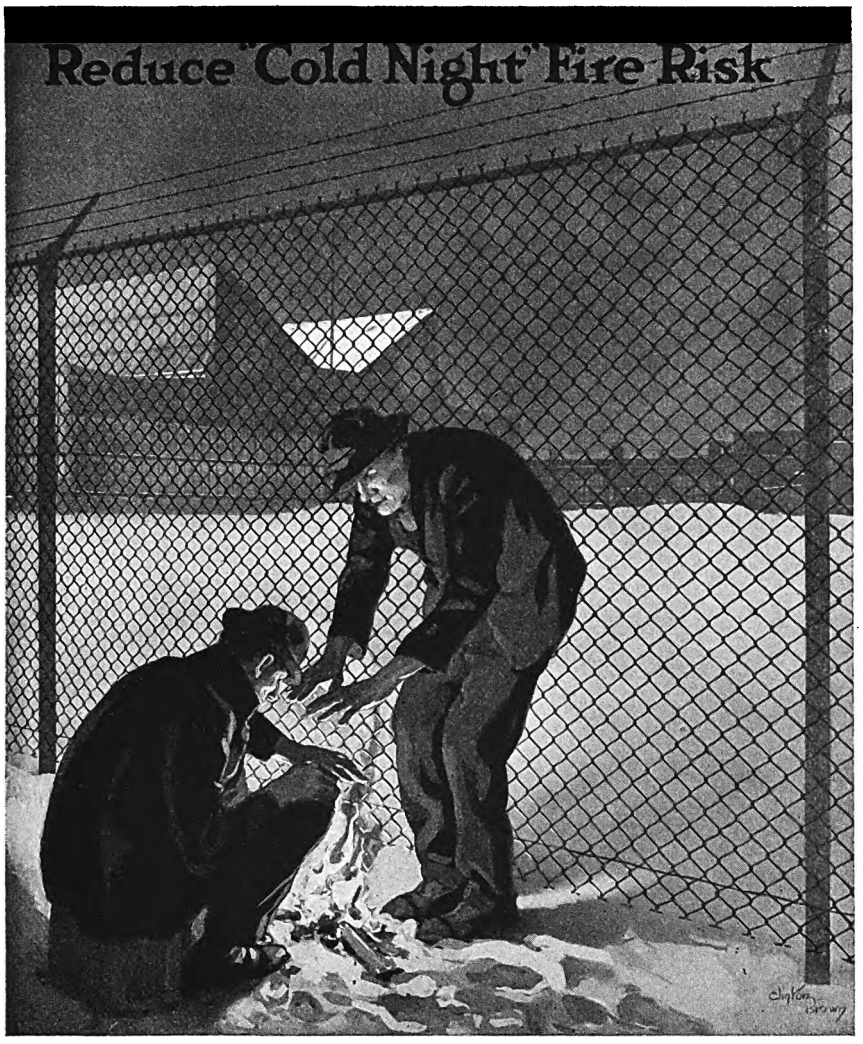
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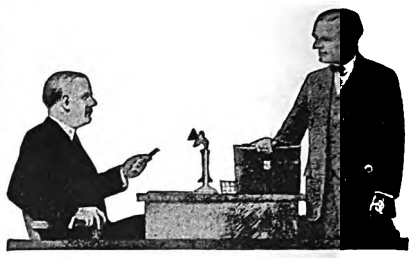
(*Continued from Page 38*)

to stand a test by racing with the fellows who could get real speed out of a bicycle. They laugh about that race yet in Hammondsport. Ten years later there was a bigger laugh about a bigger contraption of Curtiss', a laugh which likewise suffered a reverse overnight. Which way? The same guess will do for both laughs.

Curtiss wants physical speed, and he goes at it with mental speed. In two years he was entering motor-cycle races in New York on his own machines, and experiencing the thrill which comes from winning. And in another year, 1904, his racing engagements had taken him as far as Ormond Beach, Florida. On January 8 of that year, with a two-cylinder machine, he made a ten-mile record which stood unbeaten for seven years—8 minutes, 54 2/5 seconds. Three years later, at the same place, on a motor-cycle weighing only 110 pounds, he rode a mile in 46 seconds and with a so-called freak machine—a two-wheeler equipped with an 8-cylinder motor and weighing 350 lbs. he rode the fastest mile man had yet traveled, in 26 2/5 seconds. That is at the rate of 137 miles an hour! Curtiss' desire for speed is not taken out in mere longing; he goes after it, and he gets it. Over and over again has he had the sensation of whizzing through space at a pace which no man before him ever experienced. More than that, he has done it, not as a mere sportsman putting somebody else's device through its paces; he has done it always with a vehicle conceived by his own brain, wrought in his own shop, largely with his own hands. Do you often find a personality so self-contained as that?

Had Curtiss' career followed the history of the race, his next step would have been the automobile. But, curiously, his development skipped that next link in the chain of vehicular speed. It was natural enough, however. Captain Thomas Baldwin, the famous aeronaut of the United States Army Signal Corps, in 1905 was working on a dirigible balloon. The lightness of Curtiss' motor-cycle motor attracted his attention and he asked Curtiss to make one on a scale large enough to serve as the

(*Continued on page 43*)



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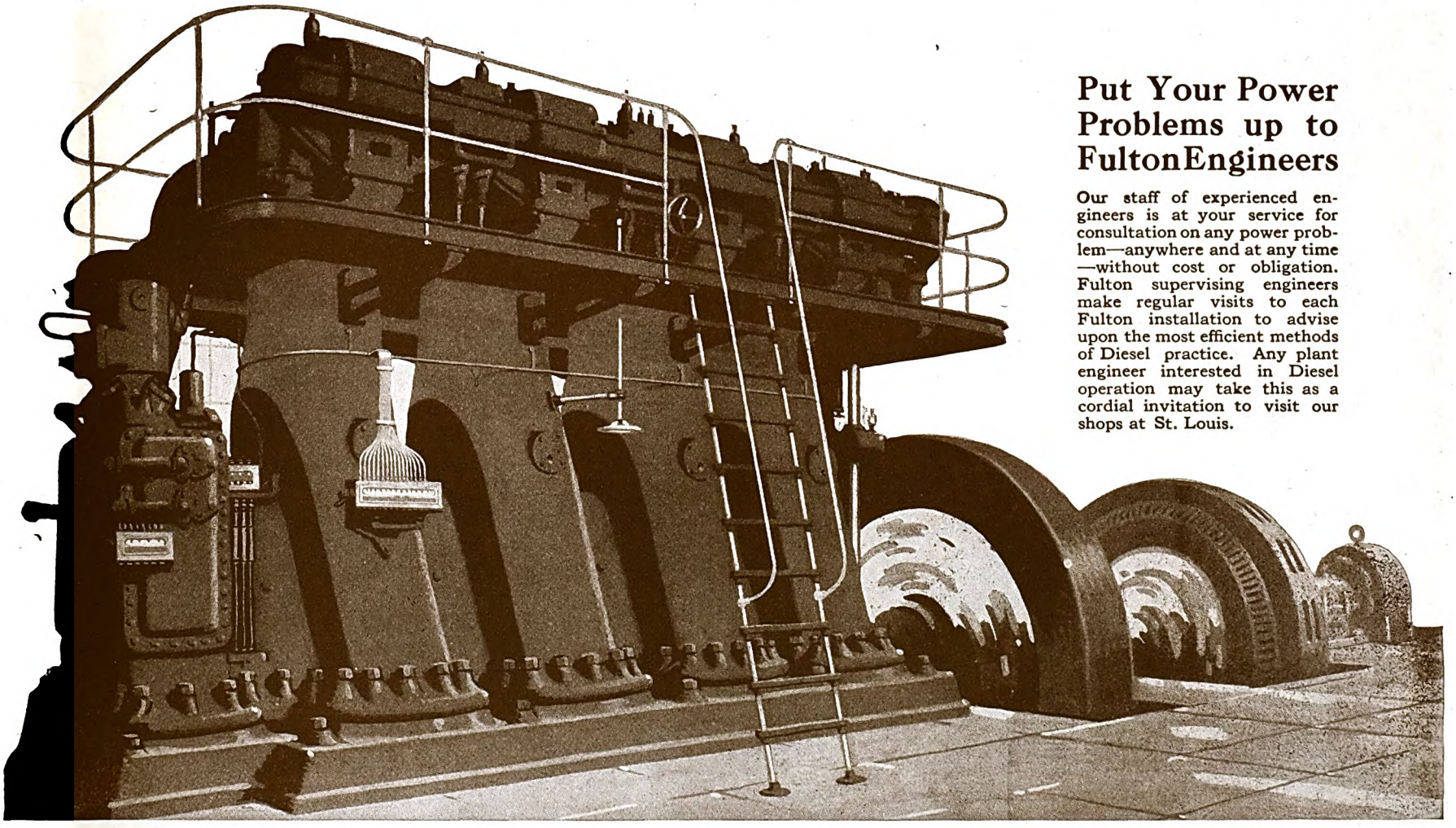
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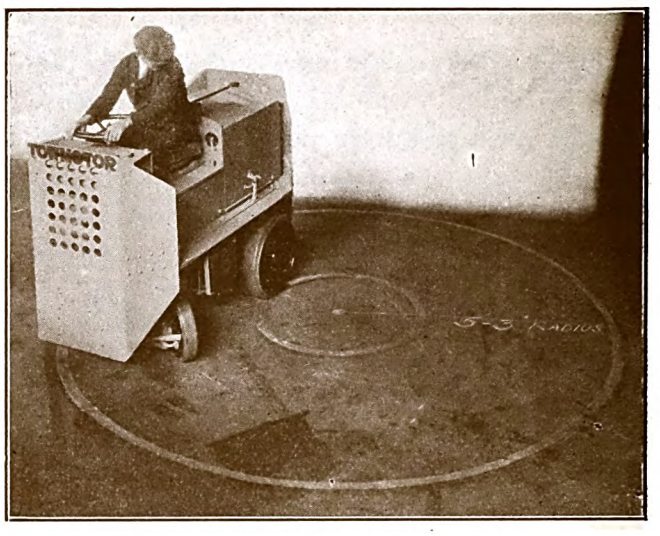
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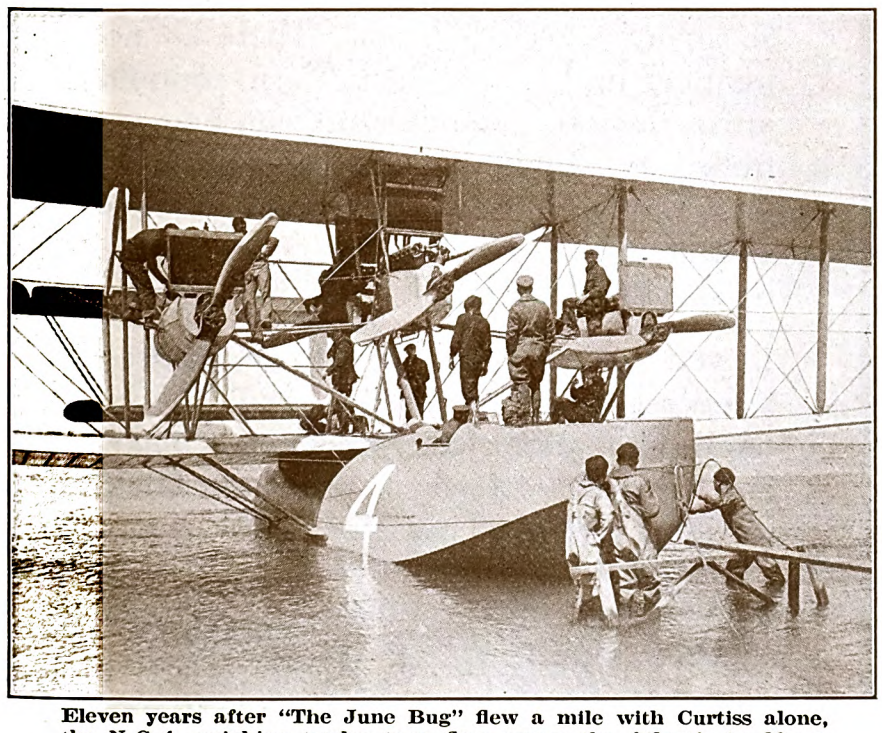
(*Continued from page 40*)

power plant of his balloon. That request was a turning-point. It definitely advanced the element in which Curtiss' speed complex functioned from the ground to the air, its planes of action from one to three.

Fellowship in aeronautical work with Baldwin, Selfridge, and Alexander Graham Bell led very soon to the formation of the Aerial Experiment Association. Each man in turn was to be the final authority in constructing an aeroplane, while all of them worked together on each machine. Curtiss' little factory at Hammondsport was the workshop. Their results at first were measured in inches. The first machine, on March 27, 1908, flew 318 feet, 11 inches. On May 22 the second did 1,017 feet in 19 seconds before it smashed. Curtiss' turn came third, and he called his machine "The June Bug," that being the month in which it was built. By this time the airplane had become a matter of sufficient promise so that *The Scientific American* had offered a trophy for a flight of one kilometer by a machine carrying a pilot who drove it under its own power. Curtiss felt enough confidence in his machine to enter it as a contestant, and on the Fourth of July "The June Bug" won the trophy. This was the first formal, announced flight to be made in the United States.

Progress was rapid during the ensuing twelve months, so the flight for the trophy in 1909 was extended to 25 kilometers. Curtiss again was the only entrant, but again his machine won the cup. He had so much margin that he kept on flying and covered nearly twice the required distance before alighting. That event was so reassuring that, at the last possible moment, he entered for the Gordon Bennett international races at Rheims, only five weeks later. His machine was actually not assembled until after it had reached France. Bleriot, in his monoplane, was expected to win, but instead Curtiss, in his American biplane, did it, August 29, 1909.

Another rush trip across the ocean, back to Hammondsport to prepare a machine for a record-breaking cross-country flight, from Albany to New York, for which the *New York World* had offered a prize of $10,000, as a feature of the Hudson-Fulton celebration. Here this article might profitably switch off to an essay on self-mastery, with Curtiss as its text. Two dirigible balloons tried the trip and failed. With the time limit shortening daily, with the celebration drawing to a close with the eyes of the world upon him, and especially those of the newspaper world, their pens growing daily sharper, Curtiss had every reason to make the attempt and have the thing over with. But this man of speed had, with it, control, self-control. At that stage of the flying art, atmospheric conditions had to be right, to assure safety and good results otherwise. And



Eleven years after "The June Bug" flew a mile with Curtiss alone, the N-C 4, weighing twelve tons, flew across the Atlantic in fifteen hours carrying six men.



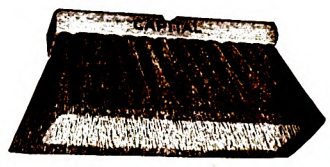
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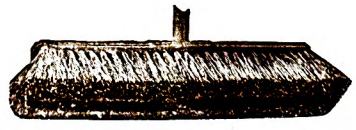
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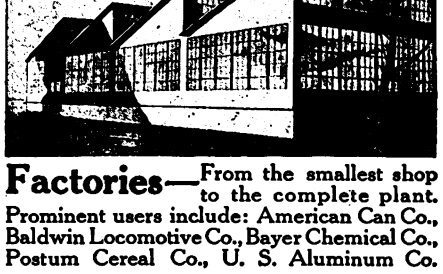
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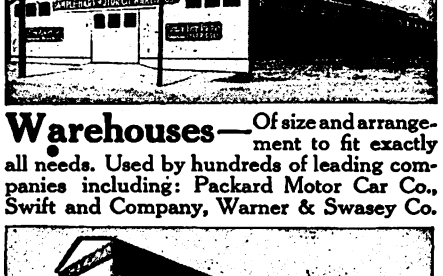
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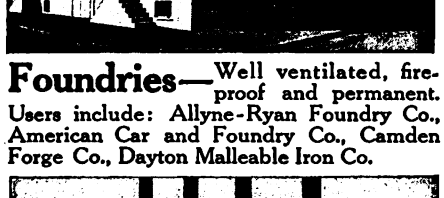
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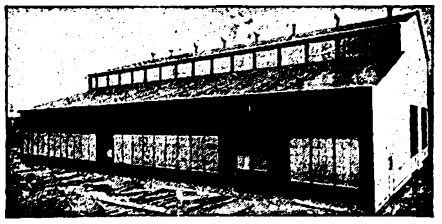
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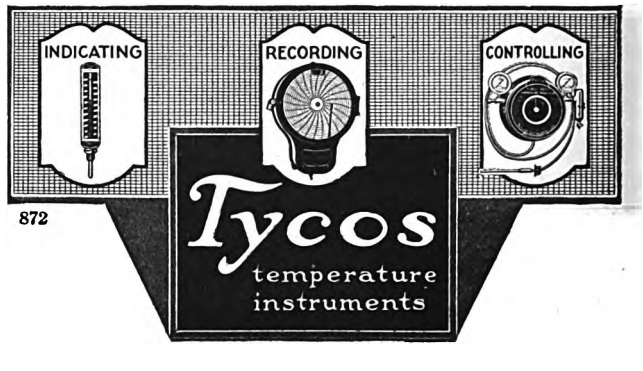
conditions were never right, in Curtiss' judgment, through so many weeks of waiting that the event had to be called off. The "wise ones" agreed that Curtiss had "pulled a good publicity stunt, anyhow." One of them would probably give any reasonable amount if he could recall the paper in which he remarked that "Curtiss gives us a pain in the neck."

For *The World* extended its offer a year, and on Sunday, May 31, 1910, the unperturbed and imperturbable Curtiss, having, with characteristic assurance, determined that conditions warranted making the attempt with fair expectations of success, made the attempt, and succeeded. He flew the 152 miles without mishap in 2 hours, 51 minutes, won *The World's* $10,000 cash prize, and became permanent owner of *The Scientific American* trophy.

That historic flight was made with a 25-horsepower, 8-cylinder motor. Step by step, refinement in 'plane and motor progressed until at Detroit, a few weeks ago, a specially built Army-Curtiss machine again carried its pilot faster than man had ever before moved through space. Its 400 horsepower motor, with twelve cylinders, delivers a horsepower for every 1¾ pounds of its weight. Such strides have been made in aeronautical science, and so deliberately are its principles worked out in Curtiss practice, that, before this machine was constructed, the tests of its small model registered an attainable speed of 219.8 miles per hour, while its actual official average speed in the race was 219.5! And it was built in less than ninety days.

Some early experiments showed Curtiss that rising from and alighting upon water presented a different set of problems from those met on land. For a few years he devoted his attention to the latter by developing the airplane. Then he set himself to working out the flying boat, a machine materially different from the airplane. Step by step the difficulties were ascertained, studied, solved—rising from the water, "landing" on it, flying from land to water, then from water to land, alighting alongside a warship and being hoisted upon it, flying from and landing on a warship's deck,

(*Continued on page 46*)



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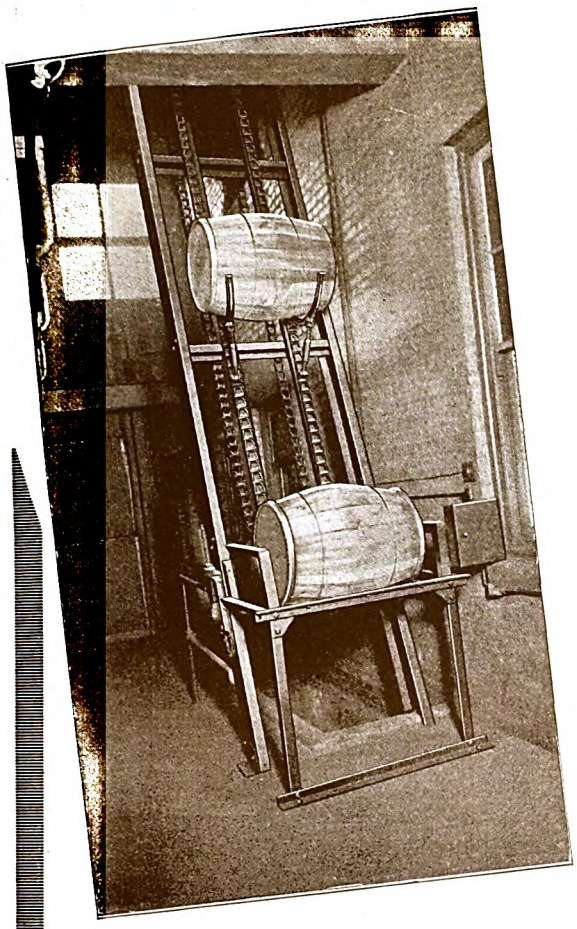
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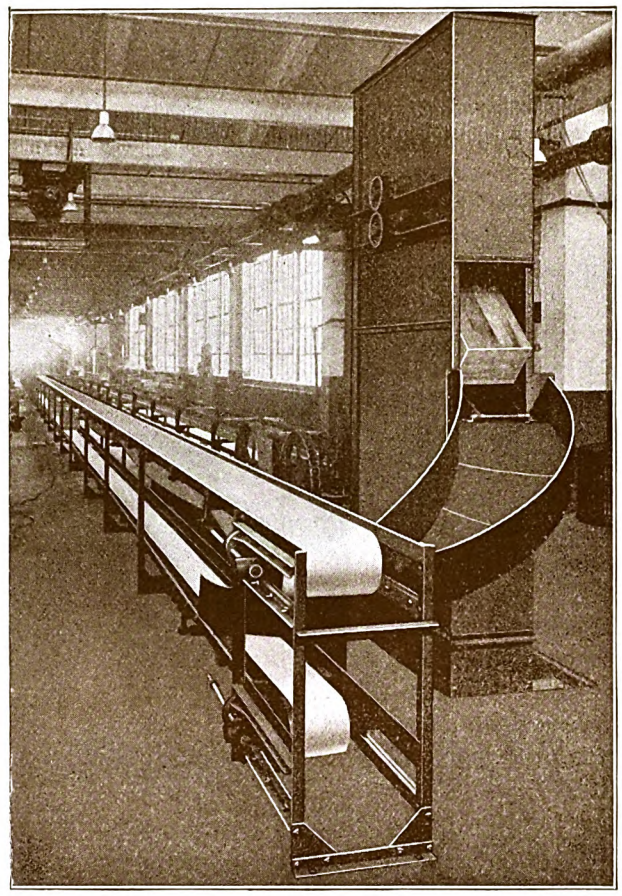
Taylor Instrument Companies
Rochester, N.Y. U.S.A.

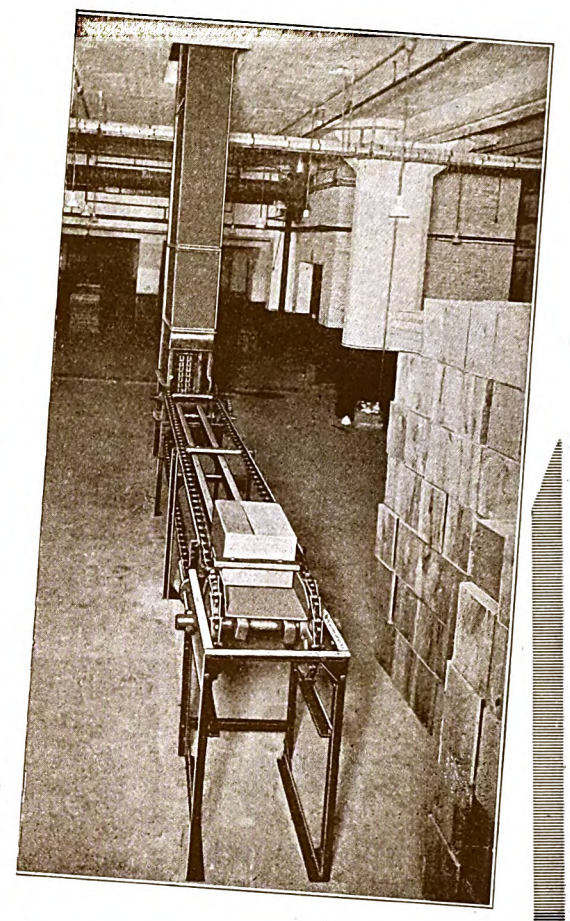
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Survey Your Plant Through The Eyes of Your Competitors.

SYSTEM immediately becomes the mooted question. True, productive machinery, such as machine shop equipment, mixers, looms, filling machines, etc., is practically standard. The equipment of this class that they have you have. But are you keeping your materials on the move so that all machines are producing constantly. That's the biggest factor of business today. And to keep products in the various stages of manufacture on the move you must use Conveying Systems.

Conveying Systems eliminate manual handling of materials, waste motion, keep operators supplied continuously with work, establish a working pace for employees thereby controlling production and carry finished product to stock room or shipping department. *Just what would a Conveying System mean to your business?* A greater productiou with present payroll which means increased sales and more profits.

Conveying systems to function properly must be designed to meet your requirements. To determine your needs an analysis must be made of your methods of manufacture which involves study of operations, routing of materials, determining maximum production and the securing of necessary data from which a Conveying System which will keep materials on the move in your plant can be designed.

We will gladly have one of our representatives call so that this matter can be discussed to your entire satisfaction.

SAMUEL OLSON & CO.

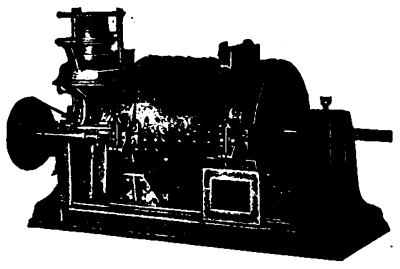
Loose, Bulk and Packed MATERIAL HANDLING SYSTEMS

2418-26 Bloomingdale Ave.
CHICAGO, ILLINOIS

5th Ave. Bldg.
NEW YORK, N. Y.

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Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY

165 Broadway New York

(*Continued from Page 44*)

carrying a passenger—until every contingency had been met, and the United States Navy was satisfied, adopted the machine as a reliable arm of the service, and named it NC, meaning "Navy-Curtiss." The brilliant, epochal climax of this development came when, on May 17, 1919, the NC-1, 3 and 4 took to the air at Trepassey, Newfoundland, headed southeast for the Azores, across the Atlantic Ocean, and in 15 hours, 5 minutes, the NC-4 landed at its destination.

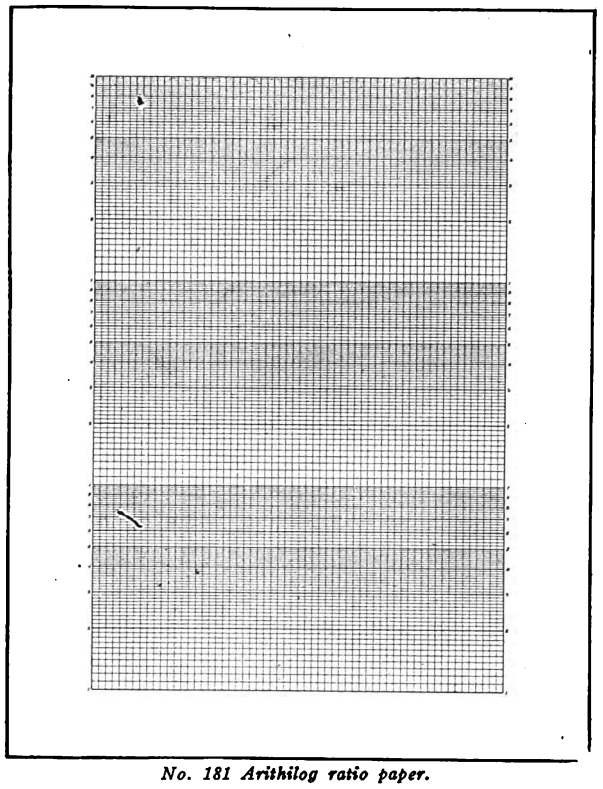
In the years between, Curtiss had introduced such innovations as dual control, so that two pilots could alternate in handling the machine; sending wireless messages to and from a flying 'plane, carrying the mails, and so on. Incidentally, Curtiss speed found a new vehicle in the shape of motor speed boats, and such winners as Miss Miami for example won with Curtiss motors. As early as 1911, without compensation, Curtiss began training Army and Navy officers in flying, at North Island, off San Diego, which is now one of the country's greatest training stations. When the United States entered the great war nine tenths of the pilots had been trained either personally by Curtiss, or in Curtiss machines. He does little flying now, mainly because in the great wind tunnel at the proving plant, by means of models, the conditions of actual flight are so perfectly reproduced that he arrives at the precise, first-hand experience which was the reason why he was his own pilot for so many years.

THE "Survey of Current Business," issued by the Department of Commerce states that price levels continued to increase in November, with both the total wholesale and the retail food indexes the highest since the end of 1921. The relative purchasing power of farm products was considerably improved in November, and this is reflected in the largest mail-order house sales since March, 1920.

The final crop reports for the year 1922 indicate a large production of the principal crops, especially wheat, potatoes and rye, and should make for increased prosperity in the farming sections.

EDEXCO CHARTING PAPERS

for putting BUSINESS RECORDS in GRAPHIC FORM



No. 181 Arithilog ratio paper.

1. They are printed on letter size paper, so that they are easy to file in letter files or bind up with typewritten reports.

2. Wide margins are left around engravings for insertion of scales, headings and notes. They are printed on white (on one side only) in a color of ink which reproduces readily.

3. They are printed on a paper which is strong enough to stand hard usage but which is unwatermarked and transparent so blueprints can be made.

4. Most EDEXCO sheets are specially divided for plotting business data by days, weeks, months and years and contain the right number of spaces for this purpose. EDEXCO curve cards also embody all these features.

TWO WEIGHTS

carried in stock for immediate delivery.

We also sell books telling how to use these papers. Our catalogue "H" describing these is free.

LABORATORY OUTFITS

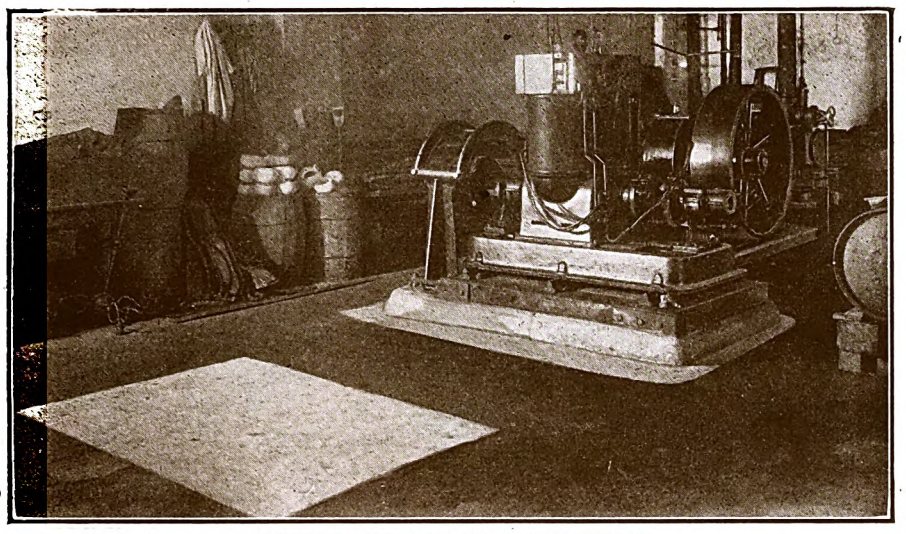
Containing instruction pamphlets and charting paper to experiment with:

OUTFIT No. 3, on General Business Charting. $2.00
OUTFIT No. 4, on Semi-Log or Ratio Papers. $2.00

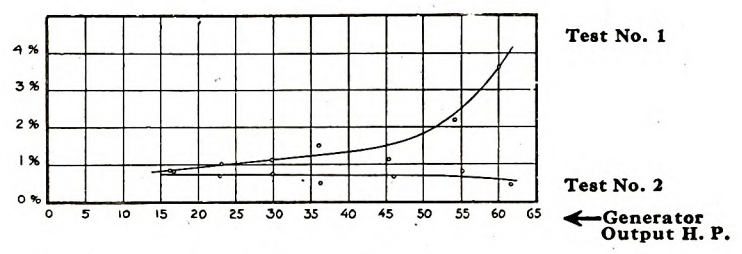
Shall we send you one or both?

Educational Exhibition Co. Graphics Headquarters
627 Custom House Street, Providence, R. I.

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WHERE THE TEST WAS MADE



BELT SLIPPAGE IN %.

¶ Saving of belt slip 86% at 60 H. P. generator output OPEN DRIVE with canvas laggings on pulleys.

Belt Slippage Reduced 86%

Two tests were made on the generator drive shown above. The results are shown on the accompanying chart.

The No. 1 test was with an open drive with canvas laggings on pulleys. In test No. 2 the Lenix drive was employed.

The results may surprise those who are not familiar with the Lenix. It will be noted that as the H. P. advanced the Lenix not only prevented additional slippage but *actually reduced it.* At 60 H. P. the saving of belt slippage was 86%.

Yet this is only one of the savings effected by the Lenix. The "Five Points" at the left mention others.

If power or floor space mean anything to you—if a steady drive means anything—you will want to get the whole story about the Lenix. A post card will bring our booklet, "Saving Slippage and Space."

F. L. SMIDTH & COMPANY
ENGINEERS
50 Church Street, New York

Five Points

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains, constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

The LENIX Drive

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FOR EVERY BUSINESS
OR
PROFESSIONAL MAN

The unit idea as first applied to filing cabinets by the Globe-Wernicke Company has made possible the standardization of office equipment for everyone.

Globe-Wernicke
FILING CABINETS

have fully demonstrated their superiority over a period of forty years. Each new unit when needed, blends perfectly with those already in use and with them becomes one piece of equipment. Made in wood or steel of the desired finish.

Agencies in all Cities. Send for FREE Catalog.

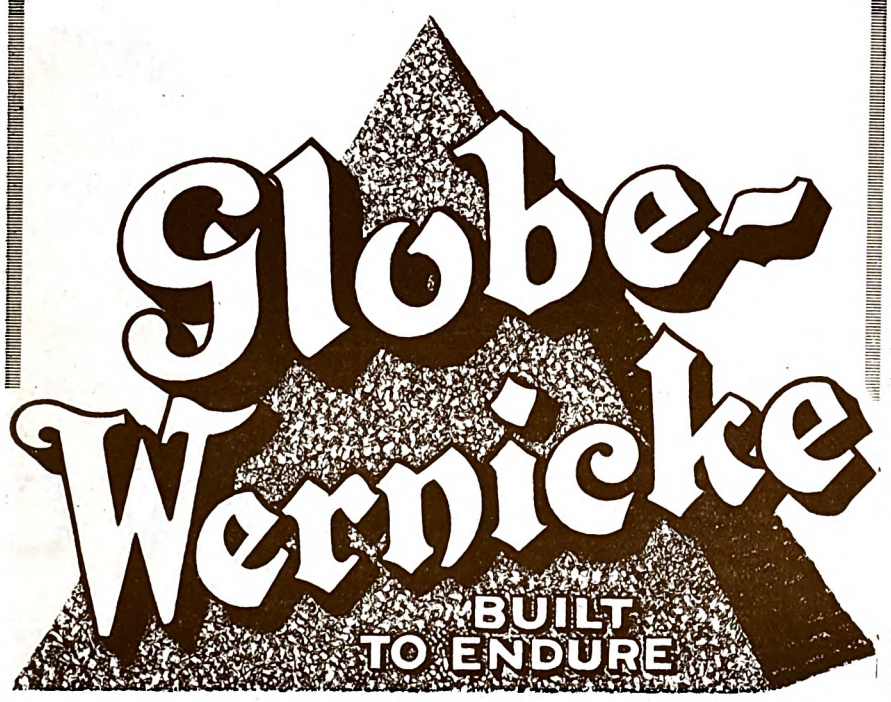
The Globe-Wernicke Co.

DEPT. II 81 CINCINNATI

Detroit
St. Louis
New York

Philadelphia
Chicago
Boston

Cleveland
Washington
New Orleans



The Use of Large Graphic Charts in Litigation

(*Continued from Page 17*)

When ready, these sheets were given to the writer who made a small sketch or layout of the chart on which was given the dimensions of the scale lines and other relevant information to be used by the draftsman who drew up the form of the chart. The data were then plotted and the plotted points were connected by the curve lines after they had been checked. The same scheme was followed in the making of the charts of the bar type which required painting. In this case the bars were drawn in in pencil and after being checked were marked with the color that was to be brushed in. When completed the charts were given serial numbers and a record was kept of them by means of a large score board fastened to the wall. The form of this score board is illustrated by Fig. 2.

PAINTING THE BAR CHARTS. Water color paint, known as show-card color was used in painting in the bars of these charts. Various colors were employed in ways to bring out the facts that were to be emphasized. The use of colors in this connecton is a study in itself. A great many of the charts were colored with but two different colors. Some of them, however, which showed a great many different factors were colored with as many tints.

The show-card color when properly applied makes a fine appearance which greatly enhances the value of the charts. One handy feature of this paint is that it can be removed from the drawing paper with clear water and a brush.

DRAWING IN THE CURVES OF THE LINE CHARTS

In the case of line charts the curves were made about one-quarter of an inch in width. Practically all were drawn with black india ink. The Stoakes pen was used for this work and proved to be a great time-saver as the lines could be drawn with one stroke of the pen.

LETTERING THE CHARTS

The scales, notes and titles of the charts, in fact all the lettering was done by gummed figures and letters. These letters were of various sizes from about ½ inch to 3 inches in height. As time-savers they could hardly be beaten. They were made of paper in black, red and white. Interesting and effective combinations were made possible by the use of the colored letters. The success of the charts was largely dependent on the use of these gummed letters. They were quickly and easily applied and made a job that could hardly be equaled by painstaking hand work with ink.

The letters were kept in alphabetical order in small boxes glued on a piece of cardboard. The photograph, Fig. 3, shows one of the chart men using this arrangement in lettering the chart. Their clear-cut appearance is plainly brought out by the charts shown in the background of the picture.

PHOTOGRAPING THE COMPLETED CHARTS

Fig. 4 is a photograph of the rack used for holding the charts while they were photographed. As fast as the charts were completed, they were set up on this frame and photographed. 8 by 10-inch prints were used by counsel for study and during the trial similar prints were handed to the members of the jury for their inspection.

FILING THE COMPLETED CHARTS.

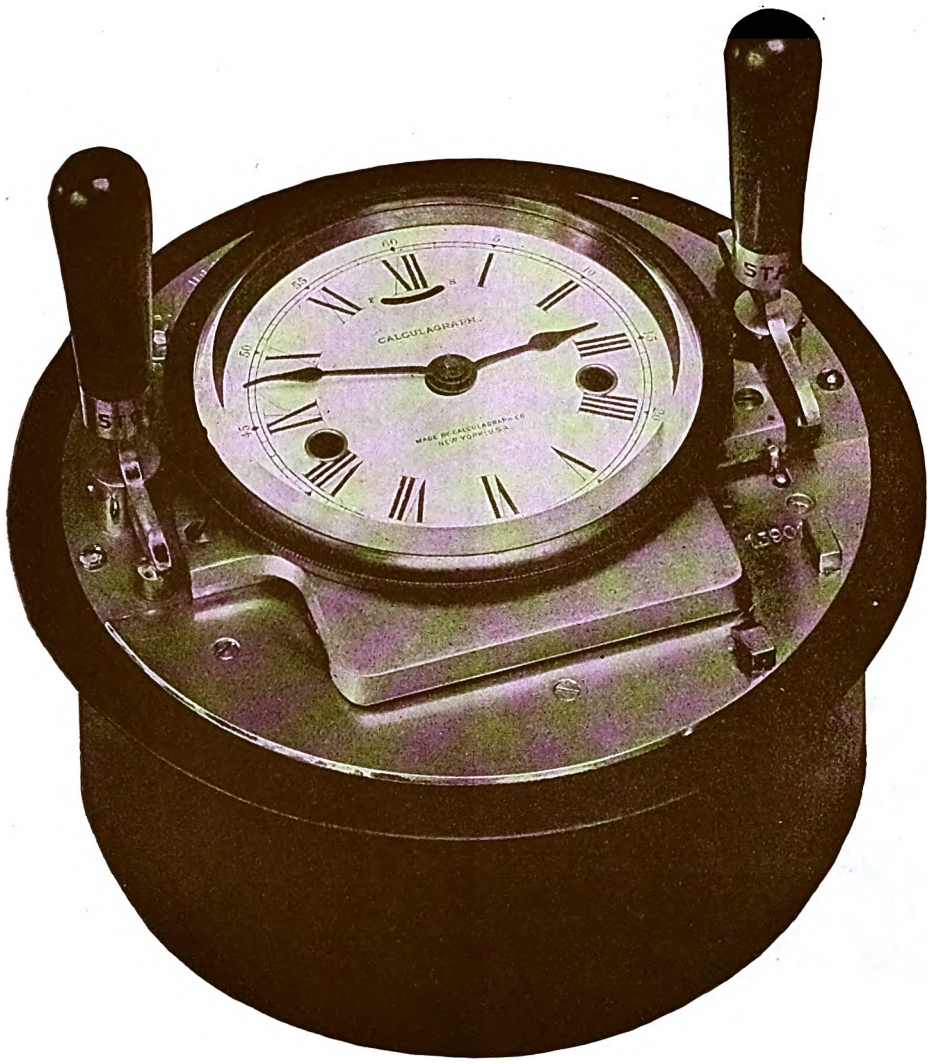
Fig. 5 shows one corner of the chart room and the racks in which the completed charts were filed. They were arranged by number so that they could quickly be pulled out for inspection. Those used in the trial were carried in these racks to the court, and this scheme provided a means of quickly displaying the charts on the easel of the court room during the progress of the trial.

USE OF THE CHARTS IN CONFERENCE.

Graphic Charts have the reputation of "showing at a glance" a great mass of tabular data. This feature was admirably brought out in the conferences preceding the trial. The charts on the various

(*Continued on Page 50*)

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You would not allow your salesmen to guess at their expense accounts.

Yet you may be guessing at production costs.

If one of your salesmen sent in an expense account reading like this, "R. R. fare from New York to Albany about $10.00, hotel bill for two days about $30.00, meals about $20.00, total about $60.00," there would be trouble immediately.

Yet you may be keeping your production costs in the same inaccurate way. When an operator keeps his own time records by the old pencil and paper system he is never exact. He guesses that the job took about so many hours or minutes and puts down his guess as a part of your time records.

There is no excuse for such antiquated methods today.

A calculagraph will record mechanically the elapsed time for any number of operators. It is a spring-driven, self contained instrument, with none of the mechanical disorders so often found in electrical time recorders. It prints right on the job ticket the starting, stopping and elapsed time of each job. It assures accurate records, saves the time and eliminates the mistakes of timekeepers.

Wherever elapsed time is a factor—in large factory or small shop—the Calculagraph quickly pays for itself as a saver of time and money.

If you have never seen our booklet, "Elapsed Time Records," write for it today.

THE CALCULAGRAPH

THE ELAPSED TIME RECORDER

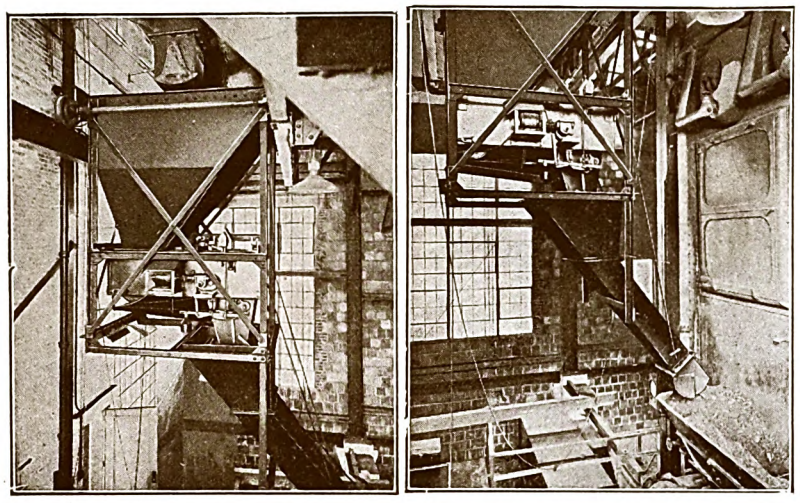
34 Church Street, New York City

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If Your Boiler is Using an Extravagant Amount of Coal,

Get After It.

Harness Your Power



Use the RICHARDSON Automatic Coal Scale

To Check the Consumption of Each Individual Boiler in Your Plant

You'll Get Better Efficiency and Save Money on Your Coal Bills

Accurate, continuous records of consumption automatically registered by the machine. Scale weighs any kind of coal successfully. Wet or frozen lumps won't phaze it. Absolutely sulphur proof and rust proof.

Faulty draft regulation, improper firing, soot, scale, holes in the fire, all tend to lower the efficiency of a boiler. A RICHARDSON will locate the trouble and you can correct it.

Supplied in the following standard sizes.

200 lb. size,	1 ton hopper,	capacity	6 tons per hour
300 lb. size,	1½ ton hopper,	capacity	9 tons per hour
400 lb. size,	2 ton hopper,	capacity	12 tons per hour
500 lb. size,	3 ton hopper,	capacity	20 tons per hour
1000 lb. size,	5 ton hopper,	capacity	40 tons per hour

RICHARDSON SCALE COMPANY

Passaic, New Jersey

New York	Boston	Buffalo	Chicago	Minneapolis
Omaha	Wichita	San Francisco	Memphis	Atlanta

(*Continued from Page 48*)

phases of the defence were exhibited to the counsel and their decisions were made with great expediency as to the proper chart to show the desired fact. It was possible to make quick comparisons of the business of the cement companies with general business by the use of these charts. They clearly and quickly showed the facts that hours of study would have but half brought out had only the figures been used.

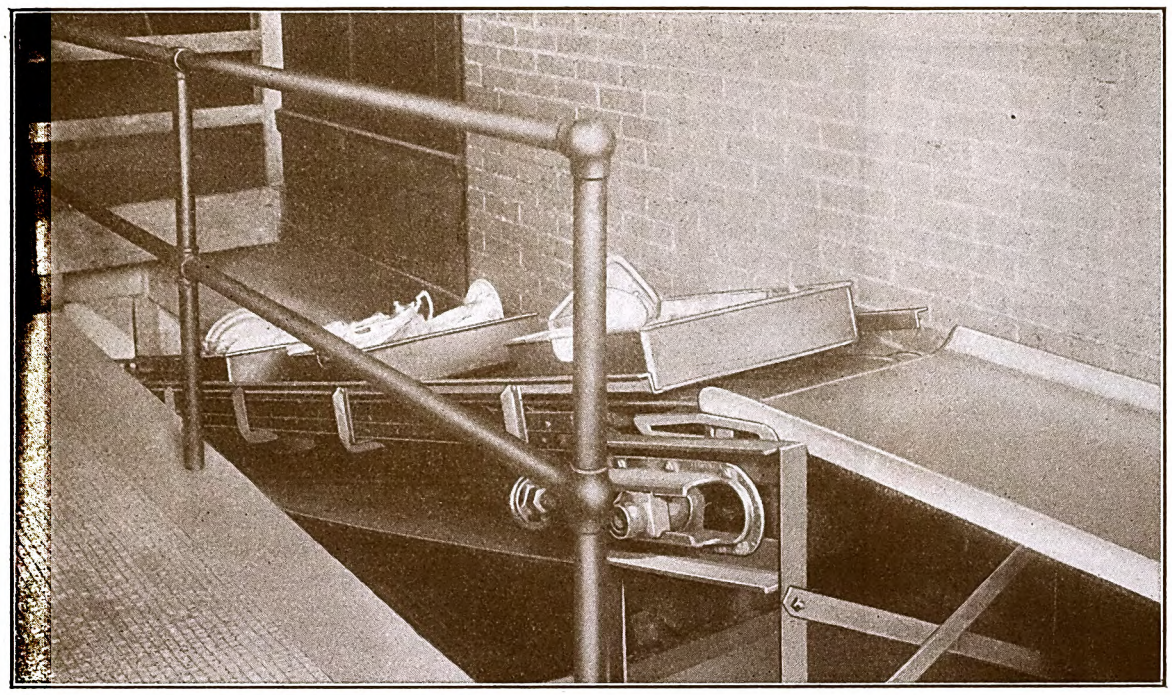
USE OF CHARTS AT THE TRIAL. It was interestng to note the effect on the court and jury by the display of the charts during the trial. As the charts were displayed on the easel they received the most earnest attention. The charts made an excellent impression and were particularly successful in relieving the seemingly dry discussions by giving the court, jury, counsel and spectators "something to look at."

ABOUT half the freight loaded on our railroads, according to an estimate made by a well-informed man experienced in both mining and transportation, is contributed by our coal mines. This portion includes coal loaded at the mines and coke loaded at the ovens, both consigned to consumers all over the country, and coal loaded for the railroads themselves, as well as articles of mine equipment and supply loaded at industrial centers more or less distant from the coal mines. Even though this figure may later be shown, on fuller presentation of the facts, to be somewhat high, the big outstanding truth is that the coal mines and the railroads are co-partners on a large scale in the business of the country. This co-partnership, based on mutual interest, —the railroads being the largest purchaser of coal and the mines being the largest customer of the railroads—gave special significance to a conference held recently between a representative committee of the American Railway Association and the United States Coal Commission.

The railroad men present at that conference showed their desire to coöperate in the work of fact-finding by suggesting subjects on which they could contribute statistical facts. The perennial topic of car shortage is only the introduction to the larger questions—what investment in railroad equipment is justified to meet the demands of an overdeveloped mining industry? What can the public afford to pay to accommodate its own seasonal demand for coal? The operating officials of the railroads can also point to the effects of seasonal movement of coal and other commodities on the cost of operation of their roads.

The coal operators are themselves not unmindful of the peak demand for transportation arising in part from the seasonal demand for coal. One large mining corporation in the Middle West has several times made its annual appeal to its customers for early purchase of coal in the form of a full page reproduction of a photograph of two huge locomotives snow-bound on the track, with the simple legend "Lest you forget 1917-18." Such a remainder is pertinent every year, for the greater part of the American public either forgets or has never learned the obvious connection between snow-clogged freight yards and delayed coal at the very time when coal is most needed. How much of this seasonal burden on the railroads can economically be avoided is one of the questions the American Railway Association can help President Harding's Coal Commission to answer. Possibly the consuming public can itself also help in lowering the cost both of hauling coal and of mining it.

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SCHENLEY HOTEL (Pittsburgh DISH CONVEYER

A Conveyer That Has Not Broken A Dish in Two Years of Constant Operation

To save the heavy expense of constantly replacing broken dishes the Schenley Hotel of Pittsburgh installed a Mathews Conveyer to handle filled trays between dining room floor and dishwashing room on floor below. The illustration above shows receiving end of a belt conveyer on which the trays gently travel on a moderate incline to the lower floor. The illustration below shows how the trays come off the belt conveyer onto a gravity roller conveyer, consisting of a short straight section and curve.

Aside from handling the dishes faster and cheaper from a labor stand point, the system has already paid for itself in saving broken dishes alone.

Mathews Equipment For Most Any Conveying Problem

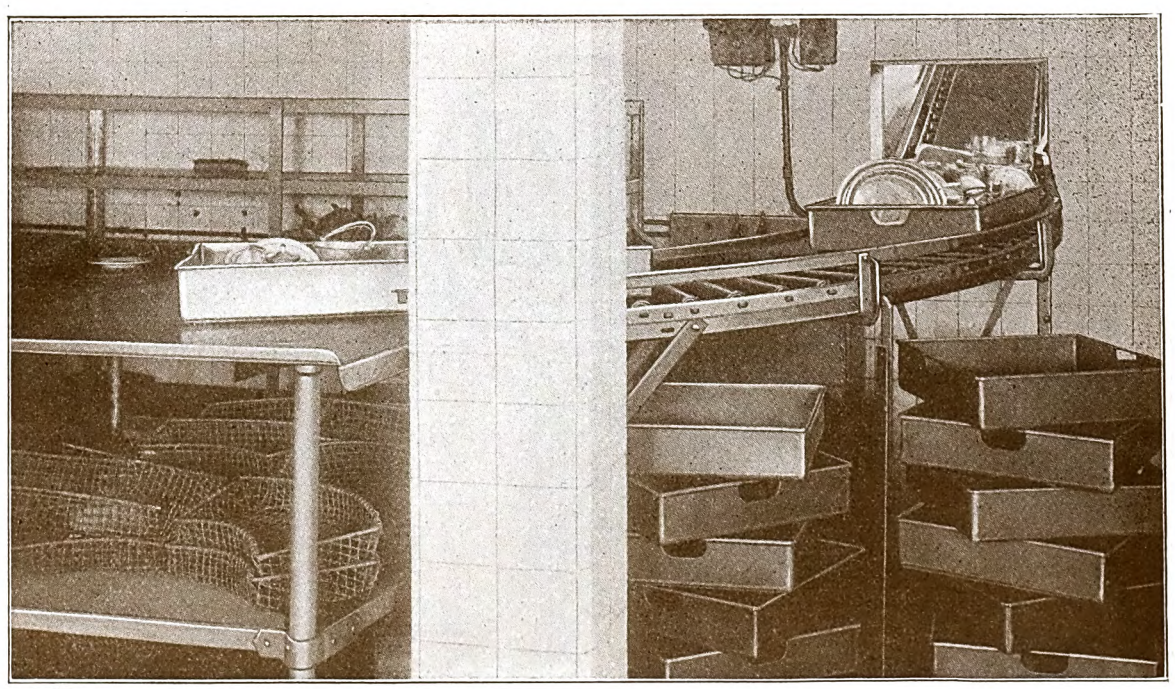
For speeding up interdepartment transportation, saving labor, saving floor space, increasing production and promoting general plant efficiency, the answer is a Mathews Conveying system. Whether its an small, portable gravity conveyer line for the shipping room or a complete system tying together all the departments of a mammoth factory, we are prepared to furnish it. Our nearest engineer will make a thorough survey and analysis of your problems without cost or obligation.

Send for your Copy of our General Catalog, and give us an outline of your problem.

MATHEWS GRAVITY CARRIER COMPANY

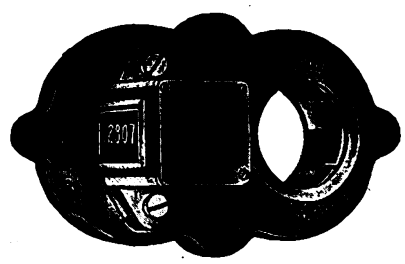
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SCHENLEY HOTEL (Pittsburgh) DISH CONVEYER

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The "C. J." Coal Meter
Stops Coal Extravagance

THERE is only one way to stop coal waste and that is by knowing the amount each boiler is using.

The "C. J." Coal Meter accurately measures the number of strokes made by the underfeed stokers. This number, multiplied by an easily determined constant, gives the total number of pounds of coal used.

No extra effort—the cost is insignificant—absolutely no expense for operation. The "C. J." Coal Meter helps determine the proportion of the load each boiler carries. It aids in detecting any faults in the boiler and irregularities in operation which lead to fuel waste.

Adapted to Jones, Taylor, Westinghouse, Sanford Riley and Detroit Stokers. Sent on 30 days' trial.

Write for Illustrated Literature

C. J. MFG. COMPANY
COAL METER
3401 N. 5th Street Philadelphia, Pa.

EFFICIENT HEATING

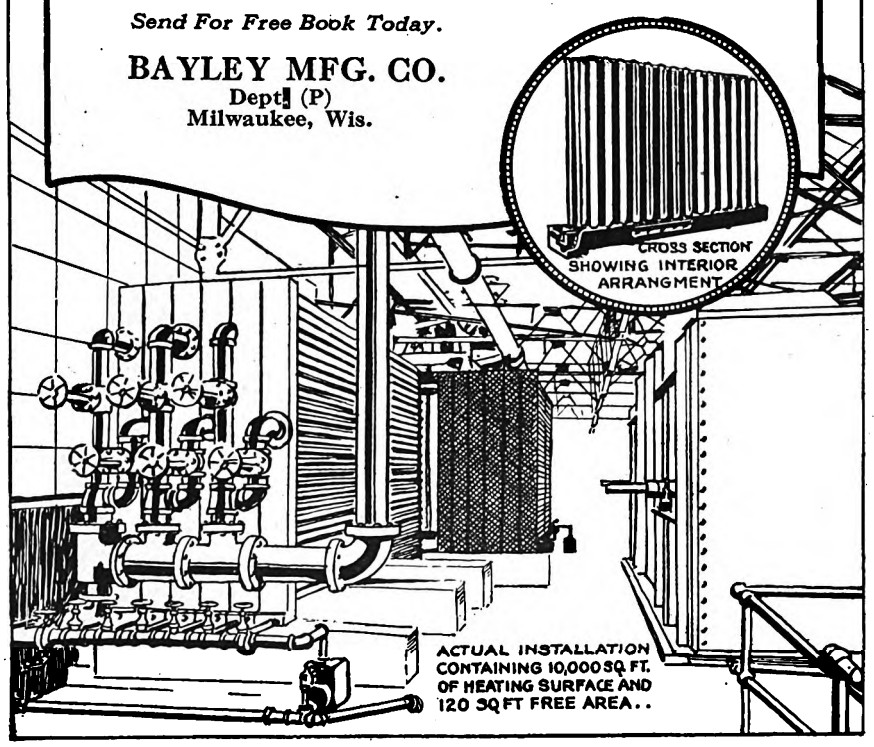
Demands Radiators so constructed that every square foot is prime heating surface.

Bayley CHINOOK HEATERS

are built on the "tube-Within-A-Tube" principle, every tube a complete radiator in itself, free from water hammer, return bends, elbows and nipples. Any tube can be removed without interfering with any other tube. Can be shipped K. D.

Send For Free Book Today.

BAYLEY MFG. CO.
Dept. (P)
Milwaukee, Wis.



The Modern Version of An Old Art

(*Continued from Page 23*)

photogravure. Its marvel lies in the fact that, with all its rapidity, and its change from flat to rotary printing, none of the perfection of the original process has been sacrificed. This is due to the microscopic accuracy maintained throughout the several steps of the operations.

Immense cameras are used, which take the double-spread pages of a newspaper in their full size. In the preliminary steps, type and pictures are handled separately, and then assembled toward the last. The pages of type are set up and photographed. In the case of picture pages, the borders are hand-drawn and the titles are set in type, making a skeleton lay-out, lacking the pictures. All this is photographed on wet film, and a film positive is taken. Pictures are copied separately on dry plates, any necessary reductions or enlargements being made. These picture negatives, carefully trimmed to the size and shape of their alloted spaces on the finished page, are laid down on a full size dry plate in the exact positions in which they are to appear, and printed thereon as positives. On this large positive plate the film positive previously mentioned is now laid down with the borders and titles in their proper positions with reference to the illustrations, so that this plate now presents the appearance of the actual newspaper page.

In the next step "carbon tissue" is used. Although there is no carbon in it, the trade name clings to this transparent gelatine film. Its surface, naturally somewhat rough, is made dead smooth by softening it and then drying it on finely japanned tin sheets. It is sensitized to light with bichromate of potash. Next the walls of the ink cells are provided for by screening the carbon tissue. It is laid on a sheet of glass scored both ways with lines, 150 to the inch. That is so fine that the lines are invisible to the naked eye, and they actually break up the light waves so that the surface is iridescent. These lines are impressed upon the carbon tissue by suction under a powerful vacuum.

Now the positive photographic print is printed upon the sensitized, screened carbon tissue. In the next step the copper printing roll comes into play. This is a beautifully fine piece of work in itself. The foundation is a cast steel cylinder eight to twelve inches in diameter. It is electro-plated with copper to a thickness of about 1/16." This has a glistening, crystalline, finely rough surface which must be made so microscopically true that a knife-blade, called the doctor-blade, as long as itself, will have such perfect contact with all points on its surface as it revolves that the blade will shave off every particle of ink and leave the surface absolutely clean. This trueing is accomplished in a lathe with rotary motions in three dimensions. The cylinder rotates in the lathe on its own axis. A polishing stone rests upon it and is carried back and forth along its length by means of a longitudinal rack. By means of a circular rack the stone is given an eccentric rotary motion in the plane of its own surface, like that of the hand in polishing a window, for example. And again, the stone rotates on its own center at the same time. The stone itself is interesting. The needed fineness and uniformity of texture are found only in a whetstone known appropriately as Tam O'Shanter since it comes from the Highlands of Scotland. It is entirely free from iron or other impurities which might make even a microscopic scratch.

Now on the beautifully polished, gleaming surface of the copper cylinder the carbon tissue is rolled, and its paper back is washed off with water. All parts of the page which are to be blank, and therefore must not be etched, are now painted out on the carbon tissue with asphaltum. Acids, applied with extreme care by expert workmen, etch through the carbon print into the copper, the depth of the etching being governed by the varying degrees of chemical change in the tissue effected by the light and dark

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portions of the photographs upon it, which in turn affect its resistance to the action of the acids.

The etching, as has been said, varies in depth from .004″ to .009″. This variation may seem so trifling as to be of no great value, but as a matter of fact it is exactly what gives photogravure and rotogravure their advantage over half-tone engravings. A half-tone is given a film of ink which can never vary in its thickness, and its effects of light and shade must be produced entirely by enlarging or reducing the individual dots which make up its surface, so that it cannot present to the eye the solid, or full-tone, effects of the original picture from which it was made. To make sure that the dots of ink do not run together and produce smeared effects the half-tone (unless it is made very coarse, as in newspaper cuts) must be printed on a very high-finished, glossy paper.

Rotogravure, on the contrary, employs soft-finished paper, for two advantageous reasons. The texture, without gloss, is more pleasing to the eye, and imparts a softness to the picture itself; and, in the darker portions of the picture, in solid lines and letters, where the cell partitions are exceedingly thin, the ink tends to run together before drying, thus enhancing the full-tone effects. The use of high-finish paper is not precluded, and sometimes is preferred.

Placed in a rotary web press, the finished cylinder prints from 3,000 to 10,000 impressions an hour. The great bulk of "roto" printing is done for the Sunday newspapers, of course, a few having their own plants. Most of it is done on contract by a few large job printing plants, for the newspapers and magazines. But more and more is the process being used for other than periodical publication. Catalogues, booklets, leaflets, even single-page pictures, are printed by grouping a number of jobs together on the printing cylinder so there will be no waste space on the paper. With such work, if it is desired to have the unit cost low, the quantities must be fairly large. It will be apparent from the foregoing description that in rotogravure the preparation cost, with the several processes and meticulous care involved, must be high as compared with older processes, while the printing cost on quantity runs on web presses, is exceedingly low.

DECLARING that there is no such thing as a spontaneous explosion, David J. Price, engineer in charge of development work of the Bureau of Chemistry of the United States Department of Agriculture, in an address before the Safety Bureau of the Chamber of Commerce today, called attention to the danger of dust explosions in various kinds of industrial plants and discussed the methods of prevention that have proved effective.

In 13 recent dust explosions in representative types of manufacturing plants, said Mr. Price, 155 lives have been lost and property and foodstuffs to a value of more than $16,250,000 destroyed. Although the first disasters of the kind on record occurred in flour mills, operators of these plants have done more, perhaps, than almost any others to eliminate the danger and control this hazard. At the present time the explosions are being reported in industries that a short time ago were thought to be safe from any such danger. Large losses of life and property have resulted from the ignition of dust in grain elevators, feed mills, sugar refineries, and starch factories. There have been explosions of dust from powdered milk, aluminum, magnesium, rubber, cork, cocoa, spice, lime-sulpher insecticide, bark, soap, and fertilizer. In a total of 110 disasters of the sort the money loss has been approximately $30,000,000, an average of more than $270,000 for each accident. This does not include the losses in connection with threshing machine explosions and cotton-gin fires.



This FREE Booklet

shows how moving air is bettering conditions and cutting costs in plants of all types.

Do it *cheaper better* with air!

HAVE you studied the dollar-saving possibilities of moving air? The savings, whether direct or indirect, easily pay the cost of the system.

Fans, blowers, and exhausters are increasing the efficiency of employees by supplying an abundance of clean, fresh air to every part of factories and shops. And in doing this they are cutting the cost of factory heating.

Applied to pneumatic conveying systems, blowers and exhausters are cutting the cost of handling material in work; applied to exhausting systems they are bettering working conditions by eliminating dust, dirt, and fumes; applied to boiler furnaces they are increasing combustion efficiency, and in foundries and gas plants they are speeding production.

The wide utility of fans and blowers—only hinted at above—is explained in this brief but thorough booklet. Don't say you know the possibilities of moving air until you read it.

Clarage Fan Co.
KALAMAZOO, MICH.

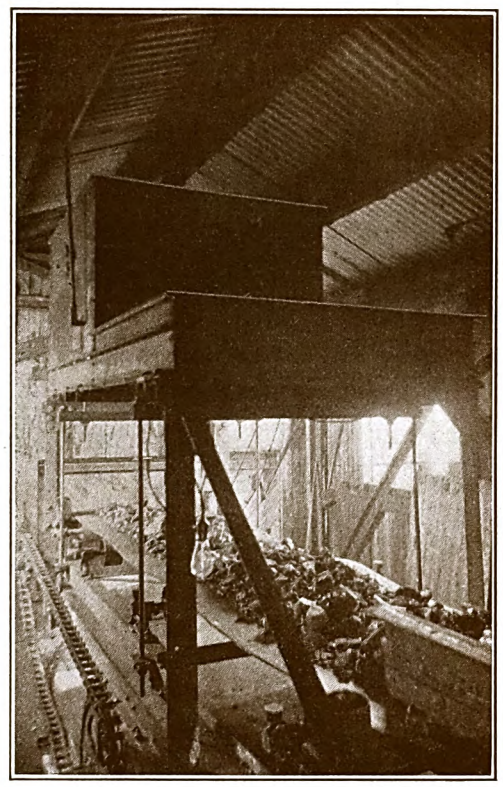
Branch offices in principal cities

MAIL THIS COUPON FOR FREE COPY
Ind. Ill. 1-23
Clarage Fan Co., Kalamazoo, Mich.
Send a copy of your booklet explaining the possibilities of moving air.
Company .....
Address .....
Your Name .....

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SAVE TIME AND LABOR
Use The
MERRICK CONVEYOR WEIGHTOMETER

Any material which is conveyor handled can be weighed without additional handling or loss of time by the Merrick Weightometer.

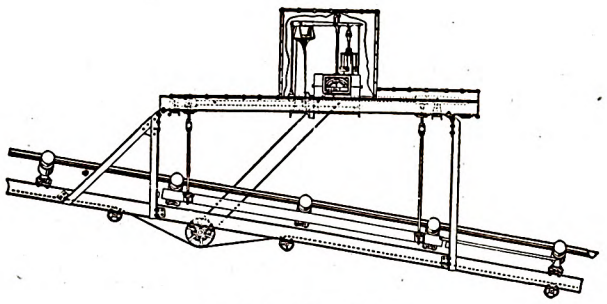


TYPICAL INSTALLATION MERRICK WEIGHTOMETER

Hundreds in use weighing all classes of materials such as

coal, run o'mine and crushed.
Coke
Stone, coarse and fine.
Gravel.
Sand.
Cement Rock.
Cement Clinker.
Metallic Ore.
Phosphate Rock.
Phosphate Pebbles.
Wood Chips.
Sulphite Pulp slabs.
Fish and Fish Products
Finished Cement
Zinc Ore,
Iron Ore.
Copper Ore.
Lead Ore.
Gold Ore.
Silver Ore.

NO WEIGHMAN OR ATTENDANT REQUIRED
GUARANTEED AND PROVEN 99% ACCURATE



Method of Installation

Why rely on Bill of Lading Weights?
Why not be able to tell exactly how much material you receive?
Hundreds of concerns buy and sell their products using Merrick Weightometer weights.

For Information Write

MERRICK SCALE MFG. CO.,

180 Autumn Street **PASSAIC, N. J.**

(*Continued from Page 53*)

Mr. Price emphasized the necessity for adopting the safety devices and practices recommended by the department. One of the most necessary factors is the coöperation of workmen with the officials of the companies in applying methods and refraining from dangerous practices such as smoking and using open lights.

THE fact that hollow spheres can be used for measuring the total light given by a lamp has been known for some time, but recently their use has increased very greatly because the new gas-filled lamps which have an irregular shaped coil filament can not be very well measured with any other apparatus. Consequently, every factory and laboratory which wishes to make accurate measurements of such lamps has to have a sphere.

The Bureau of Standards at Washington has, therefore, issued Scientific Paper No. 447, describing a large sphere built at that Bureau and giving a complete explanation of the theory of spheres as light measurers and of the precautions which must be taken in order not to make mistakes when using them. The particular sphere described is 88 inches in diameter and weighs about a ton, but for different purposes spheres from 3 inches to 10 feet in diameter have been used. Some of these, for example, are made as attachments for pocket-size "Illuminometers" and are carried about to measure the reflections from walls and ceilings and from samples of paper, paint, and other materials, while modified forms on a large scale have been used to catch the beams from full-sized army searchlights and measure the light in them.

If we wish to know the total amount of light given off by a lamp, we must not be content with measuring the candlepower in one direction only. We must measure it all about the lamp in many directions and take an average of the results. Actually to measure lamps in many different directions would require an enormous amount of time and work, and several ingenious devices

(*Continued on Page 56*)

Show the Workman He's "Getting On"

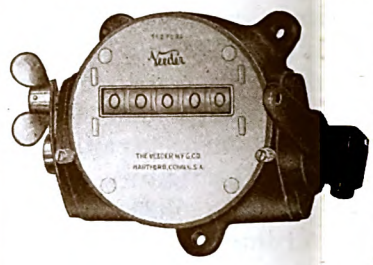
There's one way of counting production, which gives you more than a mere count. It gives you more keen, competent workmen; more "pep" in attending machines.

A Veeder Counter on a machine shows the operator how he's *getting on*, both with respect to his hourly production and his daily gains in efficiency.

It gets men *away* from a machine-like grind; gets them "into the game"; gets them forging ahead! —when their work scores on a

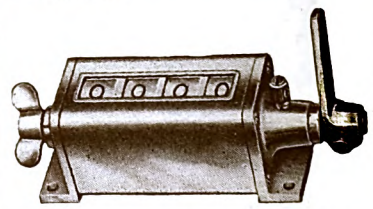
Veeder COUNTER

Here's a big new development in a Punch Press Counter; a heavy-cased ratchet mechanism, immensely durable:



Built especially for recording the product of punch presses, metal stamping machines and other heavy-duty machinery. Strong stops limit the movement of the lever to 45 degrees or ⅛ turn, which registers one on the dial. The large, legible figures are easily read ten feet away. Counter is regularly furnished with five figure-wheels, and may be set back to zero by one turn of knob. Requires no special fixtures for attaching. Price, $18.00.

The Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



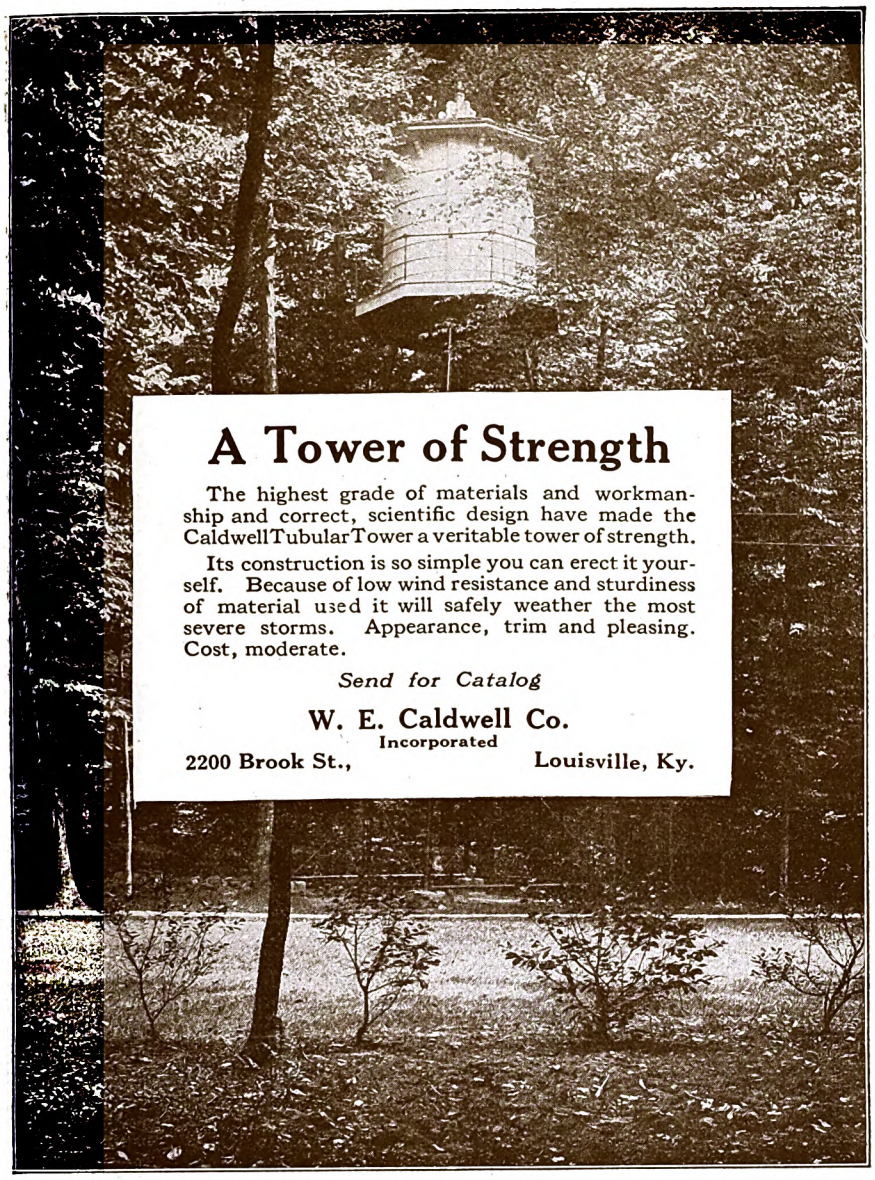
Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figure-wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter, to record reciprocating movements as on punch presses, $11.50 (list)

FREE—This new 80-page booklet shows everything you could ask in a counter. Ask for IT.



The Veeder Mfg. Co.
63 Sargeant St., Hartford, Conn.

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A Tower of Strength

The highest grade of materials and workmanship and correct, scientific design have made the Caldwell Tubular Tower a veritable tower of strength.

Its construction is so simple you can erect it yourself. Because of low wind resistance and sturdiness of material used it will safely weather the most severe storms. Appearance, trim and pleasing. Cost, moderate.

Send for Catalog

W. E. Caldwell Co.
Incorporated
2200 Brook St., Louisville, Ky.

COST Accounting

Only School in U. S. Specializing in Cost



"Opportunity" knocks but once.

So don't let this opportunity pass to investigate the J. Lee Nicholson Institute of Cost Accounting, the best school of its kind in existence.

Nicholson trained cost accountants are big valuable men of large incomes. They fill big positions because they know exactly what to do and how to do it. And here is a profession where the demand is greater than the supply.

Consultation Free

Send for Booklet

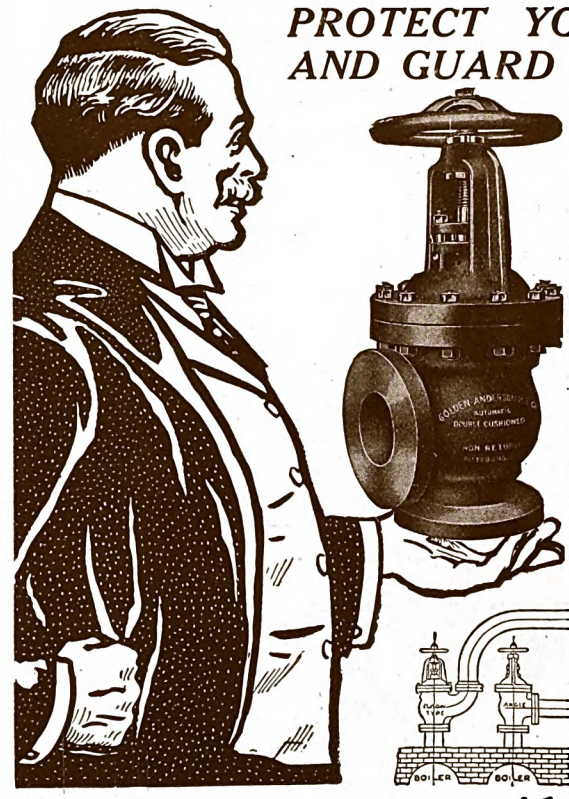
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GOLDEN-ANDERSON

"Life and Property Insurance Valves"

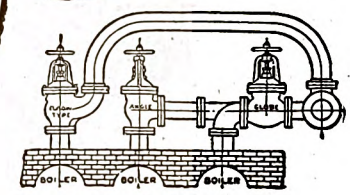
Patent Automatic Double-Cushioned Triple-Acting and Non-Return Valves

PROTECT YOUR PLANT AND GUARD YOUR MEN



DOUBLE EXTRA HEAVY VALVES

"Every Valve Sold With a Positive "Guarantee."
"Hosts of References."



4100

Golden-Anderson Life and Property Insurance Valves are used in the iron and steel industry. Their repeat orders are the result of assured protection.

These Golden-Anderson Double Extra Heavy Patent Valves give absolute protection in case of back flow, pipe explosions, or admission of steam to cold boilers.

1—Instant isolation of a boiler in the event of a bursted tube or any other internal break causing a sudden drop of pressure.
2—All steam flow cut off the moment a steam line breaks at any point in your plant.
3—Boilers automatically cut in and out of service to equalize the pressure. This eliminates cutting in a fresh boiler by hand.
4—Cannot be opened by hand unless provided with patented safety latch attachment. It prevents the possibility of admitting live steam to a cold boiler.
5—No pounding, chattering or sticking. The perfectly cushioned double Corliss Dash Pot insures positively quiet seating.
6—The only valves that can be tested from the boiler room floor.



Golden - Anderson

Automatic Cushioned Water Pressure Regulating Valves

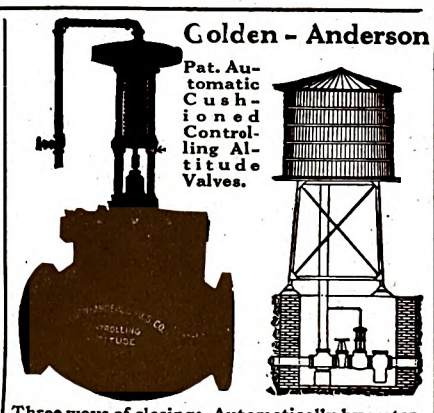
Will establish positively, steady reduced water pressure.

Easily adjusted from the outside.

Fitted with patented safety piston to remove danger of high pressure from reaching low pressure side. Cushioned by water and air.

No shock in seating.

Sizes to 30-inch.



Golden - Anderson

Pat. Automatic Cushioned Controlling Altitude Valves.

Three ways of closing: Automatically by water, electrically from distant points, and by hand. Sizes to 30-inch. No Float or fixtures.

GOLDEN ANDERSON

Patent Automatic Double Cushioned Check Valve

1—Perfectly control the reverse flow of water in case pump stops to eliminate water hammer or shock.
2—Can be adjusted to operate either quickly or slowly.
3—Especially adapted for irrigation systems, water works, etc., having disastrous reverse flow of pressures.
4—Perfect cushioning obtained by water in opening and closing.

Sizes to 30-inch Angle or Globe Pattern.

Especially adapted for Hydraulic Elevator Service.



Golden-Anderson Valve Specialty Co.
1306 Fulton Building Pittsburgh, Pa.

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MORRiS PUMPS

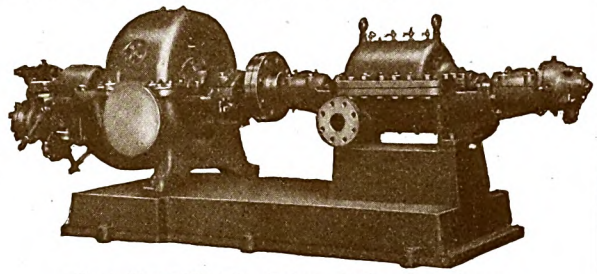
Are always making and breaking Records

Morris Pumps everywhere are meeting all demands and doing the work better. These pumps are being installed in ever increasing numbers for fire protection. For boiler feed, they are rapidly displacing reciprocating pumps. Morris Pumps are equally effective in pumping fresh or salt water, acids or other liquids as in pumping unscreened sewage or the products of hydraulic dredging.

Whatever your requirements,—your pump should be Morris Centrifugals.

Our engineers will gladly analyze your pumping problem to insure the selection of the most suitable pump for your needs. Drop a line today

Since 1864
Builders of
Dredges, Centrifugal Pumps amd
Steam Engines



Centrifugal Turbine Driven Boiler Feed Pump

MORRIS MACHINE WORKS
200 Genesee St., Baldwinsville NEW YORK

184,635 Defective Boilers

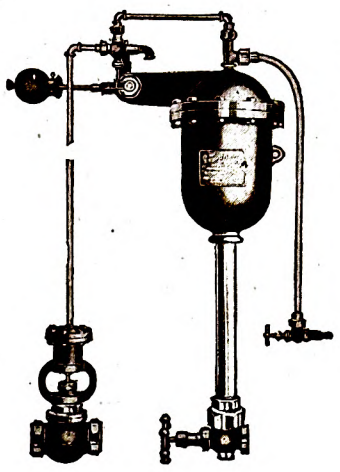
among those inspected last year—

so reports the Hartford Steam Boiler Inspection, Hartford, Conn.

You may not be able to break any boiler efficiency records but you can absolutely safeguard against explosions because of low water by installing a Vigilant Feed Water Regulator. The Vigilant holds the water to a given point. This assures that coal will not be needlessly wasted.

Too much trust cannot be placed in the human element. It is a known fact that today automatic boiler devices such as the Vigilant Feed Water Regulator are largely responsible for the high efficiencies and perfect safety at which hundreds of thousands of boilers are operated.

VIGILANT Feed Water Regulator



The Vigilant Feed Water Regulator is the premier regulator in the field and has been giving steady, reliable service for more than 25 years. There are no complicated parts to adjust or to get out of order. And it cannot fail to operate because it depends on gravity for its action. If only for the protection it affords, the Vigilant Feed Water Regulator is a good investment for you.

Just ask for the catalog

The Chaplin Fulton Mfg. Co.
28-36 Penn Avenue
Pittsburgh Penna.

(*Continued from Page 54*)

to get the same result with less labor have been invented. One of the simplest and most satisfactory of these is the integrating sphere mentioned above. This is simply a large, hollow, white-walled ball, inside which a lamp can be placed with a small window so that the brightness of the inside wall can be observed. The light is reflected back and forth between different parts of the white surface, and the sphere has the peculiar property that every part of its surface automatically sends to every other part exactly the right fraction of the light, so that the reflected light falling on the window correctly represents the total amount of light produced by the lamp.

This is true even when the lamp gives all its light upward or downward or in any other direction as well as when the light is given off in all directions. Consequently, a single measurement of the brightness of this window shows the total light given by the lamp.

Putting the Cause in Business

BY R. L. HARLOW

IF all the reasons propounded for better employer-employee relations were catalogued they would naturally and automatically fall under two main heads:

1. Moral.
2. Business.

While it would seen unnecessary to continually emphasize the employer's obligation to his employees, to his community and to his state, much will always be written on this subject; and it is all good medicine. For, I submit that any employer who is so blind as not to recognize this moral obligation toward his employees is equally blind to his obligations to the public. Conditions such as these eventually right themselves, which is another way of saying that such an employer will never be successful. (I am not measuring "success" necessarily in dollars and cents.)

Books published on this subject in the past ten years are legion, all of more or less good common sense and worth while, but writers must go a step further. It is not enough to write a book which, when read, goes on the library shelf there to lie unheeded and forgotten. Writers must take off their kid gloves and go at the subject with bare fists.

Managers, as a rule, are anxious to be good, but it is not enough to preach of future spiritual rewards by such conduct. They must be shown, and in no uncertain terms, that not only is the time yet far distant when the general public, or competition, if you will, will force equitable relationship between employer and employee—but, and what is vitally more important,—that such fair dealing, just and equitable conditions pay; that the man who has rightly solved the problem of employer-employee relations or even he who has made the most conscientious effort toward this end will make *the most money.* Badly put, mayhap, but nevertheless a fact.

Now, let us analyze human nature for a moment. What goes to make a good man? Is hears is real, living truth? Asmitting that he has not gone to sleep and that all that he listens every Sunday, even adit the sermon to which he a matter of fact, the sermon has very little to do with it, if we are willing actually to face the truth. Why, then, is he honest? *Simply because it does not pay not to be honest.* No man who does not live up to the accepted practices in business of right and wrong can long succeed any more than he can succeed socially in his community.

But too often the moral obligation is given secondary consideration in the mind of an average employer who contemplates employee plans of any sort. The paramount question is "What does it cost?" "What shall I get out of it?" "Is it an expense or an investment?" The proof of

(*Continued on Page 59*)

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THIS IS A "LANCASTER" TANK
IF AT ANY TIME INFORMATION IS WANTED ABOUT IT REFER TO
NO. _____
LANCASTER IRON WORKS, INC.
LANCASTER, PA.

RESPONSIBILITY

WHEN considering your Tank requirements, place the burden of responsibility where it belongs.

By knowledge, training and experience, the Lancaster Iron Works, Inc. is the logical choice for such responsibility.

The Lancaster Name Plate on your Tanks is assurance that they have met the responsibility in a way that makes the product worth all that it costs.

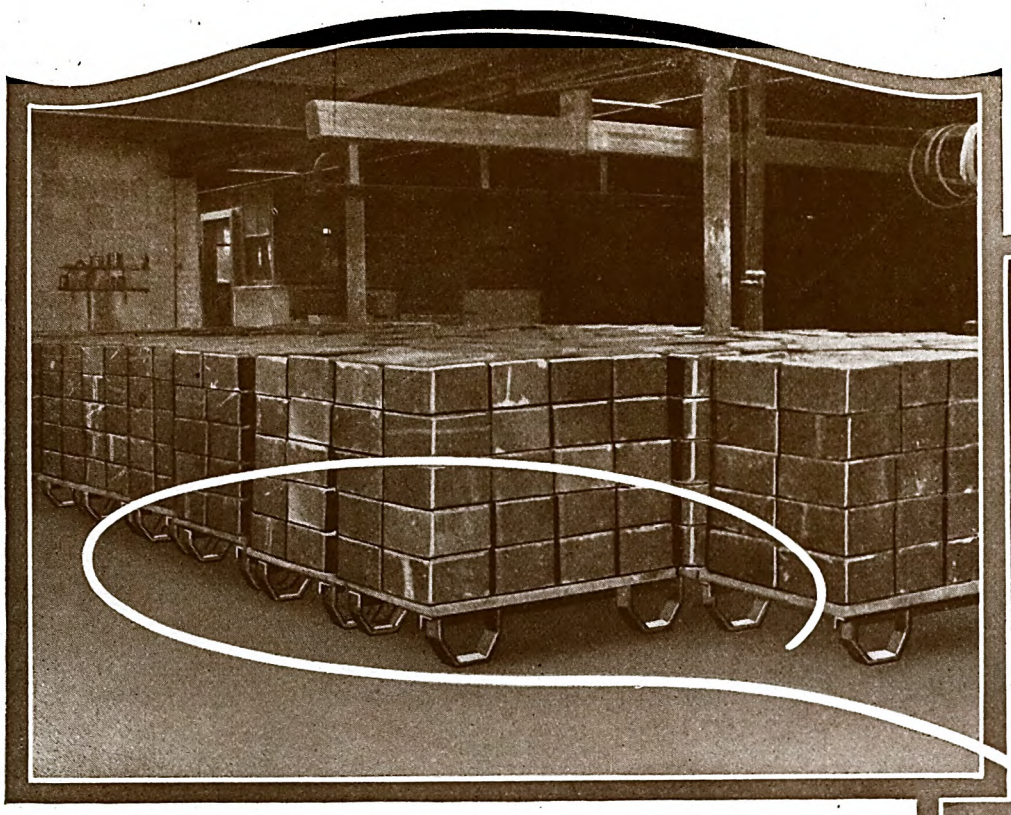
If you do not have our three valuable booklets on Tanks, we will be glad to send them upon request.

Lancaster Iron Works, Inc., Lancaster, Pa.

501 FIFTH AVENUE, NEW YORK - - - WESLEY BUILDING, PHILADELPHIA, PA.

LANCASTER TANKS
STEEL PLATE CONSTRUCTION

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One man with a single downward stroke of the Cowan Truck handle picks up skid and load.

Pressure on foot pedal lowers skid and load to floor, quickly and gently.

It Pays—
A Few Inches Raise

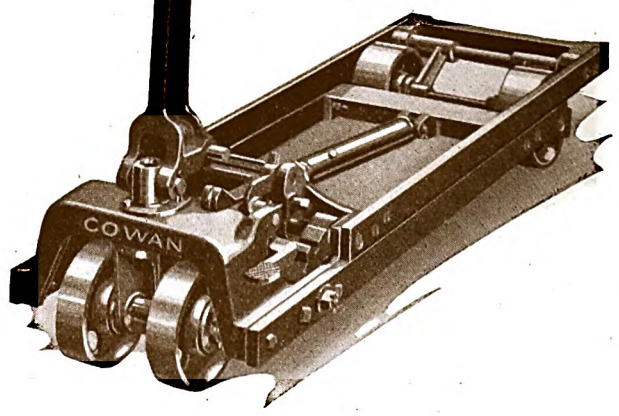
These few inches often mean the difference between savings and waste.

Goods and materials placed, piled, or stacked on the floor must be loaded and unloaded by hand every time they're moved. This is waste—in time, labor, equipment, money.

The "few inches raise" will convert this waste into many dollars of savings—cut down payroll expense, speed the movement of goods and materials, and economize in equipment and equipment maintenance.

Cowan Skids provide the "raise." Just as easy to use skids as it is to use the floor. Then one man and a Cowan Hand Lift Truck can pick up, move, and deposit loads weighing even thousands of pounds. No repeated hand loading and unloading, stacking, and restacking. No extensive equipment of platform or other similar trucks. Simple, inexpensive Cowan Skids and a few Cowan Hand Lift Trucks comprise the equipment that is eliminating the wastefulness of rehandling for thousands of concerns throughout the country.

No matter whether your problem is one of moving goods and materials from one manufacturing process to another, from department to department, from building to building, or is one of storage—whether you handle castings, lumber, boxes, bales, or what not—we have a message of enonomy for you that is worth while and convincing. A Cowan representative will gladly present it to you or we shall be pleased to send you bulletins and other information by mail.



COWAN TRUCK COMPANY, 6 WATER ST., HOLYOKE, MASS.
N. Y. Office: Grand Central Palace. Offices in Principal Cities
Largest Manufacturers of Complete Hand and Electric Industrial Truck Systems

2060-N

COWAN INDUSTRIAL TRUCKS-TRACTORS

Originators *of the* "through ticket" *system for* moving loads

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(*Continued from Page 56*)

iis statement is, for instance, ie conditions that existed in iis country during the late ar. Employers of every type id in every industry rushed out madly looking up em-oyee schemes, bonus plans, dustrial democracies and hat not.

The Personnel Manager, an-her name for a humanized ficiency engineer, became a ctor in every business. Why, ecause the war had awakened latent sense of moral obliga-on toward the worker? Not all! But because the busi-ess of these men could not icceed, *because they could not ake money;* or if the pill must sugarcoated, because they uld not longer serve the com-unity unless they could get id hold employees or labor.

The war came to an end. he "boys" came home. War ork ceased and labor once ore was easily available. rom one end of the country the other personnel man-gers were discharged; per-onnel work stopped almost ver night. Yet the problem id existed long before the war nd it is just as pressing to-ay.

The only real hopeful sign present is that while busi-ess men may have forgotten ie economic lessons of the ar, schools and colleges have rasped the importance of the roblem and today they all in-ude business courses, with pecial emphasis on employer-mployee relationships, in ieir school curriculum.

Once again may I say that hat the business man must be nown first, last and all the me is that just, equitable, hu-ane relationships pay the iggest dividends,—that the mployer who has the *enthusi-stic* loyalty and coöperation f his empoyees *will make ore money* than the mere ntractor of labor. It follows, f course, that the employees lso will benefit in proportion the success, and only in pro-ortion to the success, of any usiness.

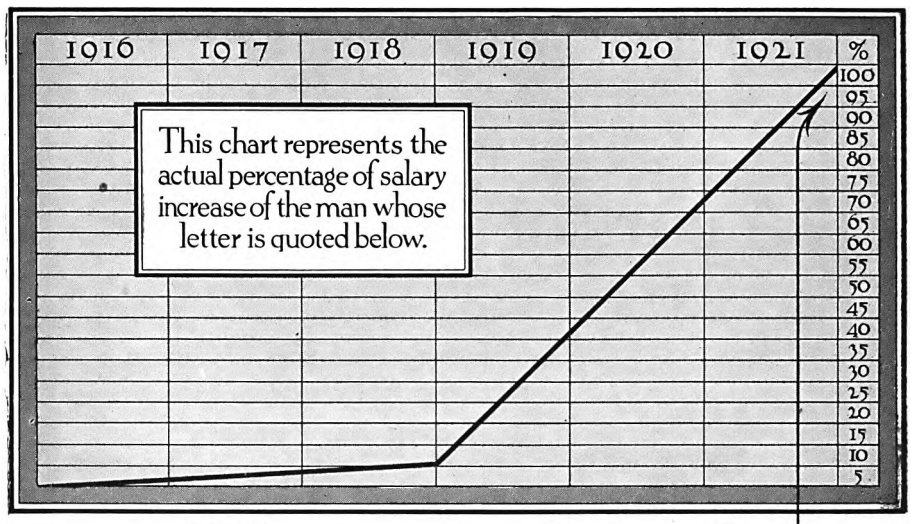
"But," says Mr. Average mployer, "I have tried these chemes at one time or another, nd the employees themselves o not use them. I have built or them a club house; I give iem lunches at noon; I have iven them a library; I have aid for their entertainment, etc., and what does it amount to?" The answer is readily found in analyzing that first statement, "*I* have given them, *I* have, etc."

Let us suppose that the Mayor of a town, on a generous impulse, built club houses for the business men of the city. Would they use them? Supposing the Chamber of Commerce laid down as a prerequisite for carrying on business in the city a membership in certain mutual benefit associations, or that business men must dine at certain restaurants. Granted that the thought in the minds of the Mayor and of the officers of the Chamber of Commerce were of the highest and the club and restaurants of the best, would the scheme work? And if not, should the business men be condemned? Further, and what is still more important, *shall we say, therefore, that all clubs and all restaurants were a failure?*

Owners there are who will never learn or freely acknowledge that those in their employ are human beings with likes and dislikes as necessary to their happiness as are their own. First let us find out what your people really want and then *help them* to get it. How? A perfectly logical question too. Well, it is often difficult, as everyone knows, to discover just what the members of one's own household really would like, say for gifts at Christmas time. This is a complaint so common, that it is the season's joke. And yet it can be solved if a resolute attempt is made.

Again, the proud father says "I am going to bring my boy up to be a lawyer or a doctor." Absurd? All the father can possibly do if he is to be a successful father is to guide that boy in the way the boy himself wants to go, provided always that the youth has had an education and experience to make an intelligent choice. One reason we have so many business failures is the determination on the part of parents to make unsuccessful lawyers and doctors out of what might have been successful bankers or mechanics.

The same rule holds in your business family. The responsibility, Mr. Manager, devolves upon you to find out, so far as is humanly possible, what are



What caused that?

ORDINARILY we subordinate the discussion of financial advantage in presenting the business value of the Alexander Hamilton Institute training.

But there is a very practical-minded type of man who insists on asking: "Just what will this mean to me in earning power? How can I *know* that the Modern Business Course and Service will help me to increase my income *soon?*"

This advertisement is written to answer that question very frankly. And the simplest way to answer it is to take, from the Institute's files, one of the hundreds of letters reporting salary increases and analyze it.

Here is such a letter, written by an official of an internationally-known concern. Let us see what prompted him to send for "Forging Ahead in Business" (the little business guide book offered below) and just what happened to him, and his income, as a result of that decision.

"After having spent several years doing the routine work connected with general business," he writes, "I worked myself up to a position in charge of a small force, but at this point

My advancement seemed to stop"

(He was just one of the many useful cogs—useful enough to be rewarded with little salary increases, but not useful enough to promote.)

"In this state I was naturally dissatisfied," he continued. "One day I made up my mind to call upon a well-known business man and inquire about an attractive position which he had to offer. His first question was:

" 'What do you know about business?'

"My many years of experience did not even afford me the ability to return an intelligent reply. Seeing my embarrassment the other man said:

" 'I am a graduate of a big university and have also completed the Alexander Hamilton Institute Course; but I consider the Course a far greater asset to me in the business world. My advice to you would be to investigate some good business study course.' "

The young man went out from that office and sent for "Forging Ahead in Business." The letter which is quoted above was written after he had completed the Modern Business Course and Service, and says:

"The main purpose of your Course has been accomplished to a great extent:

My salary has been increased about 100 per cent

since enrolling, but from the outlook this is only a small portion of the benefits still in store. Your Course has given me *confidence.*"

There is nothing to be added to the letter. We merely invite the men who read this advertisement to check their own business experience against the experience of the writer on these three points:

1. He had gone along for years with small salary increases, and his business progress seemed to have stopped. Can you look ahead to a time when this will be true of you?

2. He had an opportunity and it slipped out of his fingers because he did not know enough about Business to impress the other man. Are there opportunities of this kind that pass you by for the same reason?

3. He lacked confidence. He knew one little part of business. But just as the salesman flounders when the discussion turns to accounting, or the factory man is out of his depth in the discussion of corporation finance, he was embarrassed whenever a subject came up outside his one little department.

It is the function of the Alexander Hamilton Institute to make a man at home in the discussion of any department of business, by giving him the fundamentals underlying all departments.

"Forging Ahead in Business"

We invite you—as we invited him—to send for "Forging Ahead in Business." The training of the Alexander Hamilton Institute may or may not be what you need. Only you can decide. But surely the facts are worth an hour of your consideration.

"Forging Ahead in Business" gives *all* the facts. Sending for it has been the first step toward larger income on the part of many thousand men, including the man whose letter is quoted on this page. A copy is waiting for you.

Alexander Hamilton Institute

663 Astor Place, New York City

Send me "FORGING AHEAD IN BUSINESS," which I may keep without obligation.

Name.....
Print here

Business Address.....

.....

Business Position.....

Canadian Address, C. P. R. Building, Toronto; Australian Address, 42 Hunter Street, Sydney

Copyright, 1922, Alexander Hamilton Institute

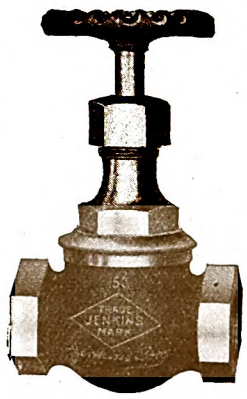
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REG. U.S. PAT. OFF. TRADE JENKINS MARK Jenkins Bros

Years of Discretion—

Early in their career, Jenkins Valves proved themselves to be thoroughly ***good*** valves. Since then they have proved themselves thoroughly ***dependable*** valves, by never once deviating from that standard of perfection.

Today, after fifty-eight years' experience, years of friendships made and kept, they are recognized as ***the*** valves of ***the*** dependable service.



Identified by the Jenkins Diamond Mark and Signature—at supply houses everywhere.

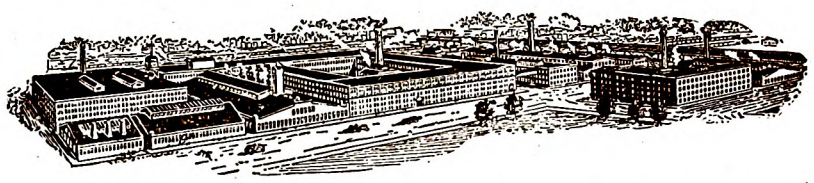
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the ideals, likes and the dislikes of those dependent so largely upon you for their future success, because you, as the living, constant example of success in their chosen field, are accountable more than any other one factor for the daily mental attitude of those who come constantly under your influence.

Because right guidance is your moral obligation to your employes and to the community.

Because right guidance will pay you ultimately even in actual dollars and cents.

No manager can evade this insistent obligation. Building hospitals or endowing libraries may make you a bigger man publicly. Developing human beings and guiding them to truest success will make you a much larger man both morally and socially.

It is not easy to find out what your employes really want, even in their business life, and you argue, not without reason, that you are too busy with the large problems ever confronting you to study out the puzzle. My answer, first, is that this in itself is one of the largest problems you will ever be called upon to face. A correct solution is difficult to state. But first make the effort, not once and then stop and declare the whole idea a failure, but constantly, every business day, and through every possible agency. Have you asked yourself in candor if, after all, you are the type of man who can find out? Have you ever made any genuine effort to know your people as you know the ledger figures of your business? Remember figures are the effect; your human element is the cause. Have you in downright earnestness studied the cause.

The average executive says he has. My answer is that generally he is merely deluding himself. Not one man in a hundred has ever made a deep study of the human side of the business. Let me ask you a question to prove it. Do you really know what your people think of you? I don't mean what they call you to your face, but how they speak of you in their own homes and among themselves? Do they refer to you as the "Big Boss," "Old Man," "Old Grouch," or are

(*Continued on Page 63*)



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CONTENTS

Preface

Introduction—The Descent of the Principle of Production for use.

1. **The Power Industry as an Economic Factor.**
2. **The Location of Plants.**
3. **The Equipment of Plants.**
4. **Mastering Materials.**
5. **Mastering Maintenance.**
6. **Mastering Labor Problems—Conditions.**
7. **Mastering Labor Problems—Compensation.**
8. **Mastering Processes.**
9. **Mastering Records.**
10. **The Analysis of Expenses.**
11. **Power as a Commodity. Index.**

The Author

has served the New Haven Railroad as superintendent of power; the Board of Estimates and Apportionments of the City of New York as expert engineer for municipal plants; and, during the war, the United States Shipping Board Emergency Fleet as power expert. In the public utility field he established a record for economical operation, both on electric railways and in central stations, his pioneer work for the Penn Central Light and Power Company particularly receiving much attention.

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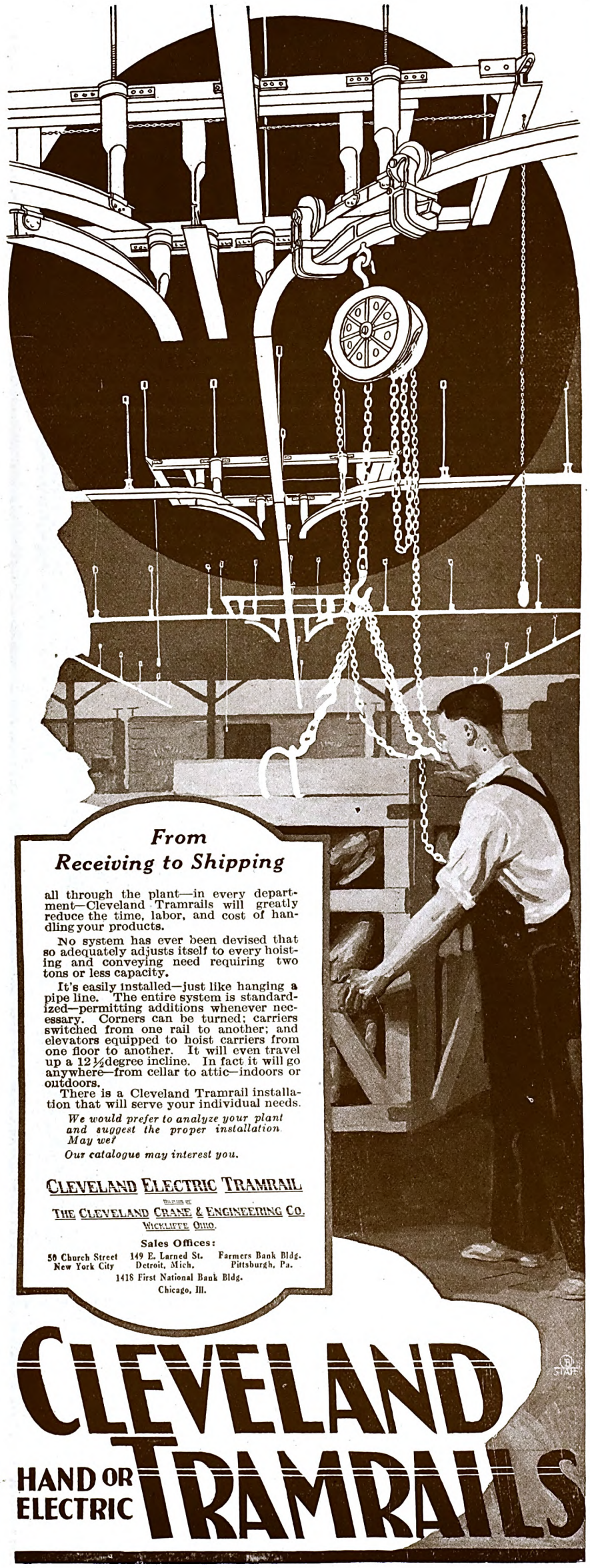
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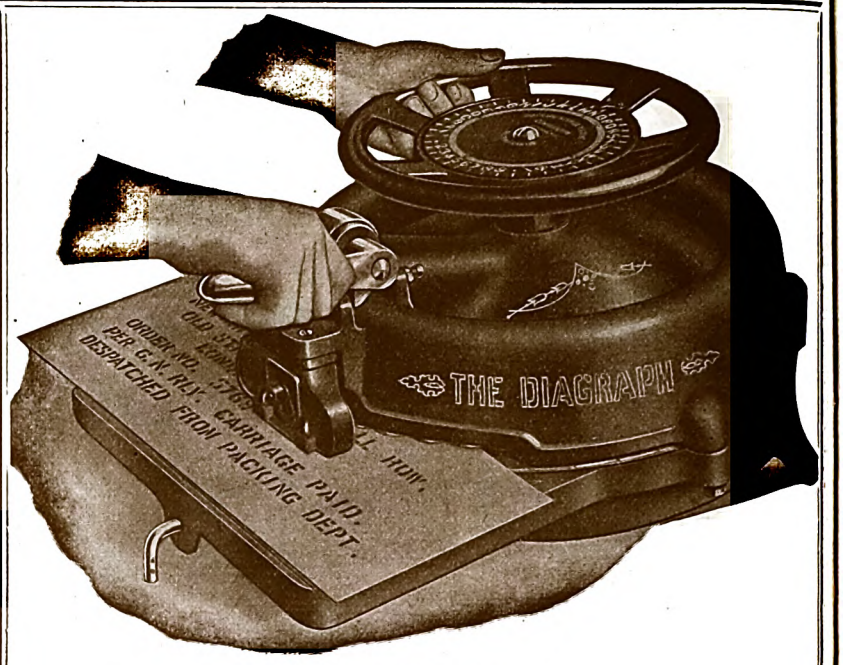
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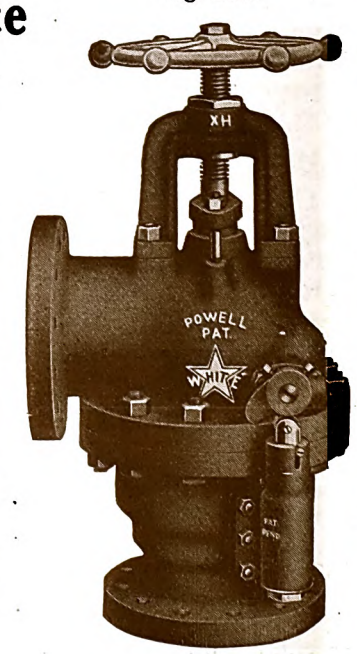
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(*Continued from Page 60*)

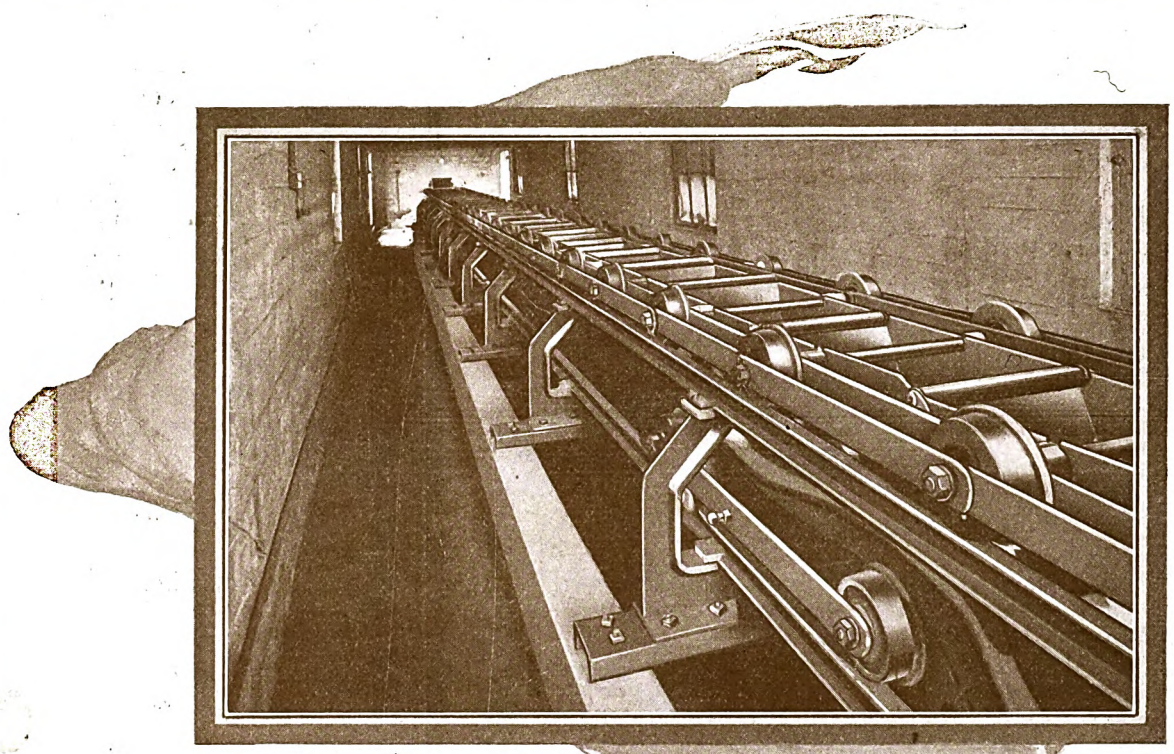
they using some more kindly term? What are your executives saying about you around the noon lunch table? You don't know and you are afraid to inquire, for your first impulse would be to "fire" as disloyal an employee who wasn't respectful in his reference to his executive head.

Obviously, it takes a big man to make this study. But this is the first job you have before you. Have your people any profound confidence in you as a *man,* or is it merely respect for your business ability? What have you done or are you doing to instill such true respect on the part of your employes for you as a leader, as an exemplar? What employe would venture to tell you that the joke just worked upon him and that he laughed at was old when he was a baby? You'd tell your partner quickly enough and one employe would not hesitate to tell another, but he would not dare to tell *you* and you wouldn't dare let him.

It is time you, figuratively speaking, got out of your expensive automobile, got down on the ground and rode in the flivvers and street cars with your employes. The "powers that be" didn't give you your success because of some peculiar characteristic personal to you but not common to humanity in general. There are probably now many men in your employ whose potential ability is even superior to yours. Is not the effort to discover it worth while in order that it may be capitalized to both yours and the employe's advantage? Consider that suggestion a moment.

The rule that responsibilities go with power is just as true in your case as it is in that of your minor executives. Greater even, for you have an added responsibility—that to the whole community. When you go through your store or factory are you wearing scowl or a smile? Do your people work harder (which truly analyzed is "bluff") when you pass by than they do when you are out of sight, in your office? Is your presence a signal for "Look out; here comes the boss!" Remember as a boy, "Cheese it, the cop!" Are you "always looking for trouble"; is that the impression you give, or are you really watching for opportunities to help to the mutual benefit of both the employe and yourself? Do your employes freely come to you for solution of their business problems which, after all, are your problems, or had they rather take a chance on the solution themselves through fear of you? Put simply: are your employes at any hour you may appear glad to see you? Are they proud because you are their executive? Are you the ideal personification of business success in the minds of the majority of them?

These questions are all real, ever present. They are vital to your greatest success. True, full answers might give you some uneasiness; but the chances are better than even that the solution of many of your own business difficulties might be found in them. Mr. Manager, if you'll stop trying to be a big boss and start try-

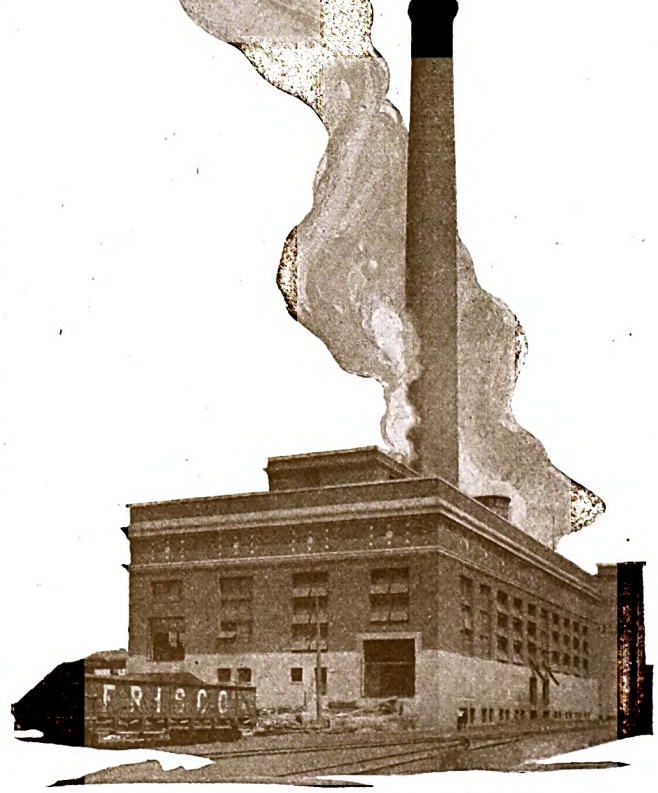


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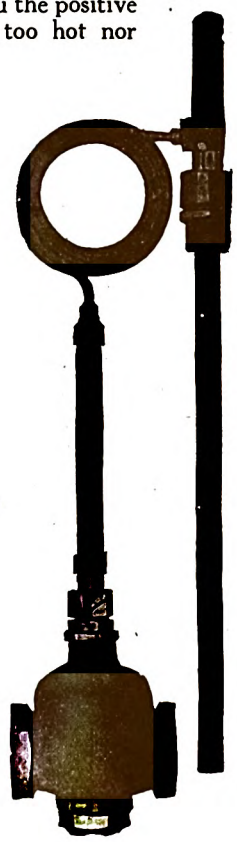
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ing to be a big man you'll be surprised how much fun there really is in the life of each day. Again, I want to emphasize that the likes and dislikes of your employes are not dissimilar to your own. Are they?

What, after all, is your chief desire in business? A better income honorably earned and better living conditions? Have you any employe whose desires are not just that?

Above all, cease putting yourself in the position of final judge as to the total, real ability of your people. What right have you to say whether the salesman today may not some day be a bigger man than yourself? If you look around at the business world, you'll find that ninety percent of the guesses made in school as to the future of the boys were wholly wrong. If teachers and parents can't guess correctly, I ask, by what authority do you so confidently predict their future?

You want, perhaps, another automobile; your employe may long for a fur coat. The chances are about even that you can't afford the coveted machine any more than can the employe the coat. By what abstract right, therefore, do you criticize that employee's expenditure? Is there not a beam in your own eye?

Study your people, Mr. Manager. Cultivate them. You need them just as much as they need you, and you'll be surprised after a while what a really splendid lot of boys and girls you have working *with* you all along.

So much for the boss!

Now then, what do I mean by the "cause" in business? All ventures fail or succeed largely upon the *individual appeal of the cause of the venture itself*. As applied to modern business, the future of our establishment depends in the last analysis upon the extent to which we can make the cause of that business a real individual responsibility of the employe and not merely of the Management.

Let me give a real example of a "cause." Suppose we decide to go into the business of war. We start out to "hire" an army, we tell our applicants that they will be subjected to the most rigid discipline, they must obey without question every command; they must give up all home ties and finally be prepared to sacrifice if necessary even life itself. For all this service we agree to give them sufficient clothes to cover them, food and housing and thirty dollars a month. I am asking you now to think of this purely from a business standpoint. How many men do you think you could enlist? But inject into the proposition the plea of "patriotism." Then sacrifices of no kind are too great to be made for that cause.

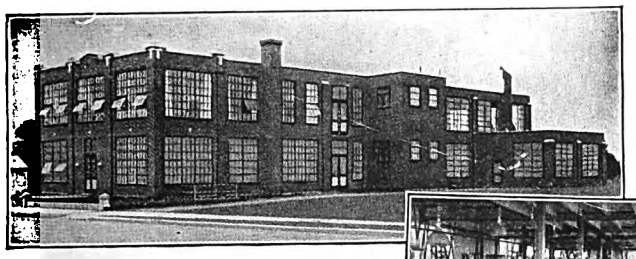
To put it differently. Take a company of soldiers in a trench. Orders have come through to kill or drive out the enemy and capture a certain wood. In the minds of the officers it is good business to pour as much shot into that wood as possible. The men, therefore, are given their orders and are told where to fire, and just when to open up. Then every officer in the command,—representing your executive in business,—passes up and down the line critizing the way Private Jones or Corporal Brown holds his gun and the fact that Private Brown shot out of turn, while Private Smith didn't even look where he was shooting. What becomes of the "cause" under such circumstances? But along comes a new captain. He explains to his men with earnestness, clearness and enthusiasm that the "one big job ahead of this company is to take that wood," and then adds, "Follow me!" Is there then any question of the result?

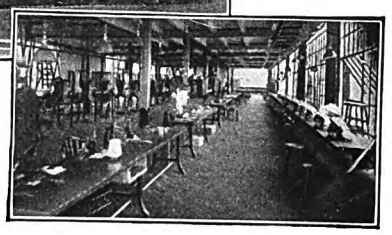
We often hear in business that "what we actually need in this establishment is more discipline." And I heartily agree. We all need more discipline. *But* how many of us know that the word discipline comes from disciple, and a disciple is a follower? What we need surely is more discipline, and in order to obtain it, we must have leaders, not task masters.

One trouble with most managements today is their desire to drive instead of lead, a course which immediately kills the "cause." The outstanding figures as leaders in all wars are not the officers who directed the battles from points miles behind the lines, but the officers who were seen

(Continued on Page 67)

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Another striking example among many is found in the Masonic Temple, Chicago, erected 1889, in which Byers pipe has for 33 years maintained its original serviceability.

Wherever you travel, equally impressive records of pipe durability can be found in old buildings equipped with the genuine wrought iron pipe—the only kind of pipe ever made by Byers. The Tacoma Building, Chicago, America's first skyscraper; the Iroquois Hotel, Buffalo; the German Insurance Building, Buffalo; Cleveland Arcade and Garfield Building, Cleveland—these are just a few notable examples.

In many of these buildings, plumbing and heating fixtures have been replaced by more modern equipment, but the old pipes have been left undisturbed, being in an excellent state of preservation after 30 to 40 years' service.

And this is a most fortunate circumstance, for cutting into walls, floors and ceilings to replace rusted-out pipes, is an operation entailing staggering expense, loss of rentals, endless confusion, and inconvenience to occupants.

Whether you build a home or a large building, Byers pipe is the most economical pipe to use for Plumbing and Heating. It represents the "happy medium" in *first* cost, and —due to its high rust-resistance—the lowest *ultimate* cost.

NOTE: Black or galvanized pipe of every variety is erroneously called "wrought pipe" or "iron pipe". Byers pipe is made by the old puddling process in use for over a century. The rust-resisting quality of the metal thus obtained has never been approached by products of cheaper modern processes. Byers is the genuine wrought iron. Judge its future by its past.



Genuine wrought iron pipe, from County Jail and Criminal Court Bldg., Chicago, in perfect condition after 44 years' service.





Send for Booklet, "On the trail of Byers Pipe"

A. M. BYERS COMPANY

PITTSBURGH, PA.

Established 1864

New York Philadelphia Boston
Chicago Cleveland Houston

Look for the Name and Year rolled in every length

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(*Continued from Page 64*)

in the front line trenches. Such are the men who came out of the war loved and respected by their subordinates, their comrades.

There may be no question about the Management working, but the worker wants to see him occasionally. The fact that he is laboring behind closed doors in an attractive office is not enough to inspire the average worker with the "cause" of the business. And he not only wants to see him but to feel wholly free to speak with him. Any executive who is too old fashioned, dull or obtuse to recognize this and feels that he is lowering his dignity by mingling with his employes is unwittingly working to destroy the "cause" of his business.

Now for the executive under you. How many leaders have you, Mr. Employer, in your business? Think them over carefully. How many real executives have you by whom you would care to have the non-executive pattern? How much good work are you doing toward the solution of employer-employe relations which is being constantly undone by your executives?

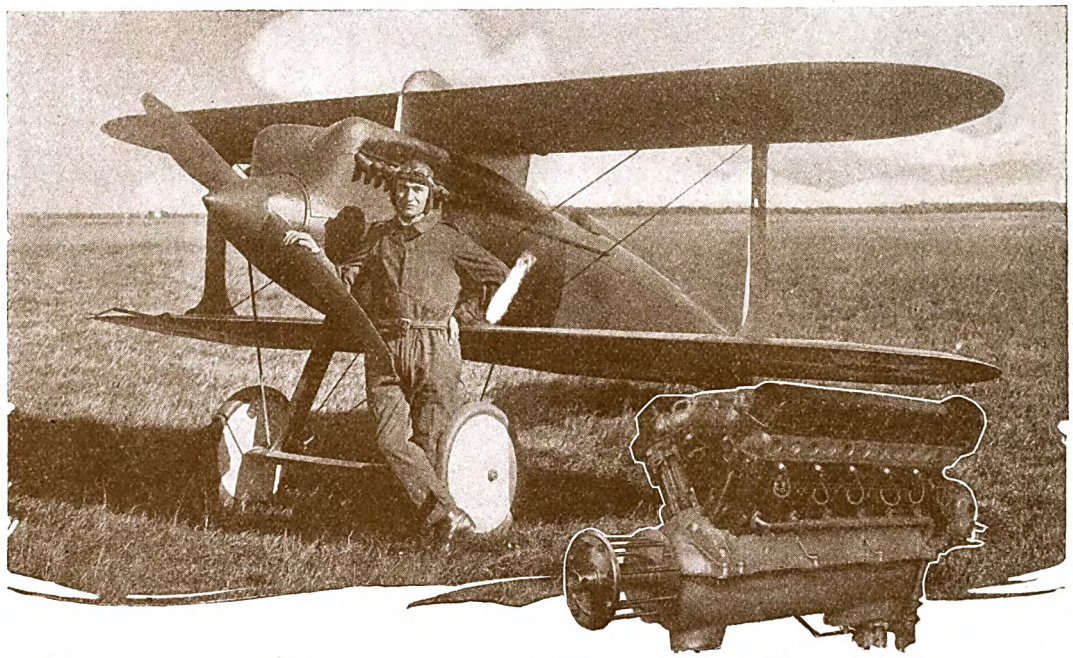
You can spend all the energy and time you like discussing ideals of the business with the rank and file, but is it not so much wasted energy if you have not first sold those ideals to the executives who are the immediate example of that rank and file? Miss Brown says, "Why should I be so careful to come in on time when my superior is late every other day and nothing is said just because he happens to be an executive?" And Miss Brown is right. The Management does not say anything to her "boss," because that particular individual may be doing a creditable piece of work in his present position. In fact, that executive may be doing immeasurable harm. Is he not sowing the seeds of discontent, or something worse by just his example? He is daily drawing the line between non-executive and executive, between class and privilege.

What has been already said as to respect for the owner of the business is equally true as to the executives under that head. Why does the average executive feel that he must "blow somebody up," who is in a subordinate position because of the "call down" he himself got from someone higher up? And what redress has the non-executive for such a "call down," and what has become of the "cause" of the business, of the owner's ideals in the mind of that non-executive? Of what use is it for the Management to expend their energies trying to awaken the rank and file to a realization of their responsibilities when that same rank and file have every day before their eyes examples in their immediate superiors to quite the contrary?

If the Management would give sufficient thought to educating the executive to the ideals of the business, the rank and file would be no problem, for unconsciously perhaps, but nevertheless to a large degree, do they not follow the examples of the executive to whom they are responsible, and with whom they come in constant contact?

Now, for a moment let us consider the successful small store. Here we have no personnel managers, no hospitals no employe restaurants, and

SKF



Deep-Groove Ball Bearings

Take Propeller Thrust at 248½ Miles Per Hour

THE hitherto unattained speed of 248½ miles per hour was achieved by Lieut. R. L. Maughan on October 17th with an Army-Curtiss Racer, equipped with a Curtiss D-12 engine developing 460 H. P.

The force developed through the 7½ ft. propeller, turning at 2,300 R. P. M. with a peripheral speed of over 10 miles per minute, was communicated to the plane through a single deep-groove radial ball bearing, 5.9 by 1.1 inches in overall dimensions, made by the Hess-Bright Manufacturing Company.

A similar bearing took the propeller thrust on the Curtiss Army Racer with which Lieut. Maughan won the Pulitzer Speed Trophy, on October 14th, for a distance of 250 kilometers—average speed 205.8 miles per hour.

The Curtiss company were pioneers in the use of deep-groove ball bearings to take propeller thrust and the latest performances merely confirm the dependability and stamina of this type of bearing under unusual service conditions.

THE HESS-BRIGHT MANUFACTURING COMPANY

Supervised by SKF INDUSTRIES, INC., 165 Broadway, New York City

887



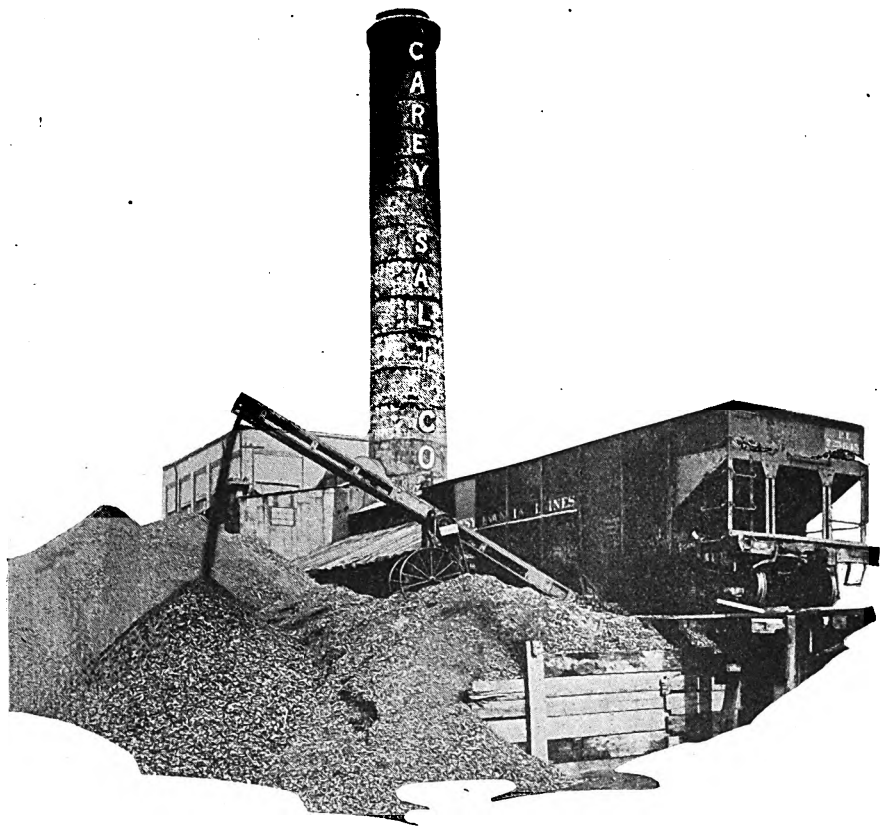
Races displaced to show DEEP-GROOVE bearing carrying maximum end thrust in a forward direction.

Races displaced to show THE SAME bearing carrying maximum thrust in reverse direction.

BALL BEARINGS

The Highest Expression of the Bearing Principle

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Unload a Car For 3 Dollars

THAT'S real economy.

That's what Scoop Conveyor users are doing.

That's what you should be doing.

Are you going to keep on giving away 12 or 15 dollars with every car you unload or are you going to catch on and direct this 12 or 15 dollars into the proper channels?

With a Scoop Conveyor cars can be unloaded at any point along the track without a pit or track hopper. The scoop end of the machine is placed next the rail underneath the car hopper, the hopper is dropped and the conveyor carries the material away as fast as it flows through. No laborious and expensive hand shovelling.

Under average conditions a fifty ton car is unloaded in from 1½ to 3 hours.

Thousands of users are saving time, trouble and a lot of expense by use of this equipment. The machines are also used for loading trucks, storing, reclaiming and transferring all kinds of loose materials.

Write for Catalogue No. 158

Portable Machinery Co.

PASSAIC, N. J.

ask any user

THE SCOOP CONVEYOR

yet if it is basically right to have such things at all, one would think they were just as important for the small store as for the large, providing the small store is to grow and is called upon when small to compete for its labor against concerns which have these things.

But the answer lies in the fact that the small store actually has these very things under a different name like, let us say, the salesman's padded expense account. The manager or owner is one and all in himself. He knows all his people by name; further, he knows something about them individually, and what is more important, they know him. They know when business is good and when it is bad. They know when the boss is not feeling well; they divine when domestic troubles have upset him; and in some respects they know even more about him than he does of himself. Consequently, he still remains a man,—something of flesh and blood like themselves. If they want a raise or a day off, or are in sudden trouble, the owner is the one they speak to, not some employment manager who, in all likelihood, will never be an owner himself. The cause of the business is a real, intimate, tangible cause. They know when they ask for an increase whether or not, in most instances, the business will warrant it. But the business grows and the owner finds it necessary to employ an assistant. Immediately your cause is one step removed until the manager or owner lands on a floor many feet above the street, behind closed doors in a luxurious office into which "rush fools where angels fear to tread."

What has become of your cause? Is it to be supposed that the line of executives, through which this cause has to pass to reach the rank and file, will all interpret the ideals of the Management as you wish them interpreted? By the time your cause reaches its destination, it is a weak, sorry little thing, indeed.

And who's to blame? The rank and file,—the Management or the executives? The closer you get to the top of any business the more real the cause of the business becomes. This is well exemplified in the work and function of the private secretary. She still stands in the same relationship to the owner of the business as does the shop girl in the small store.

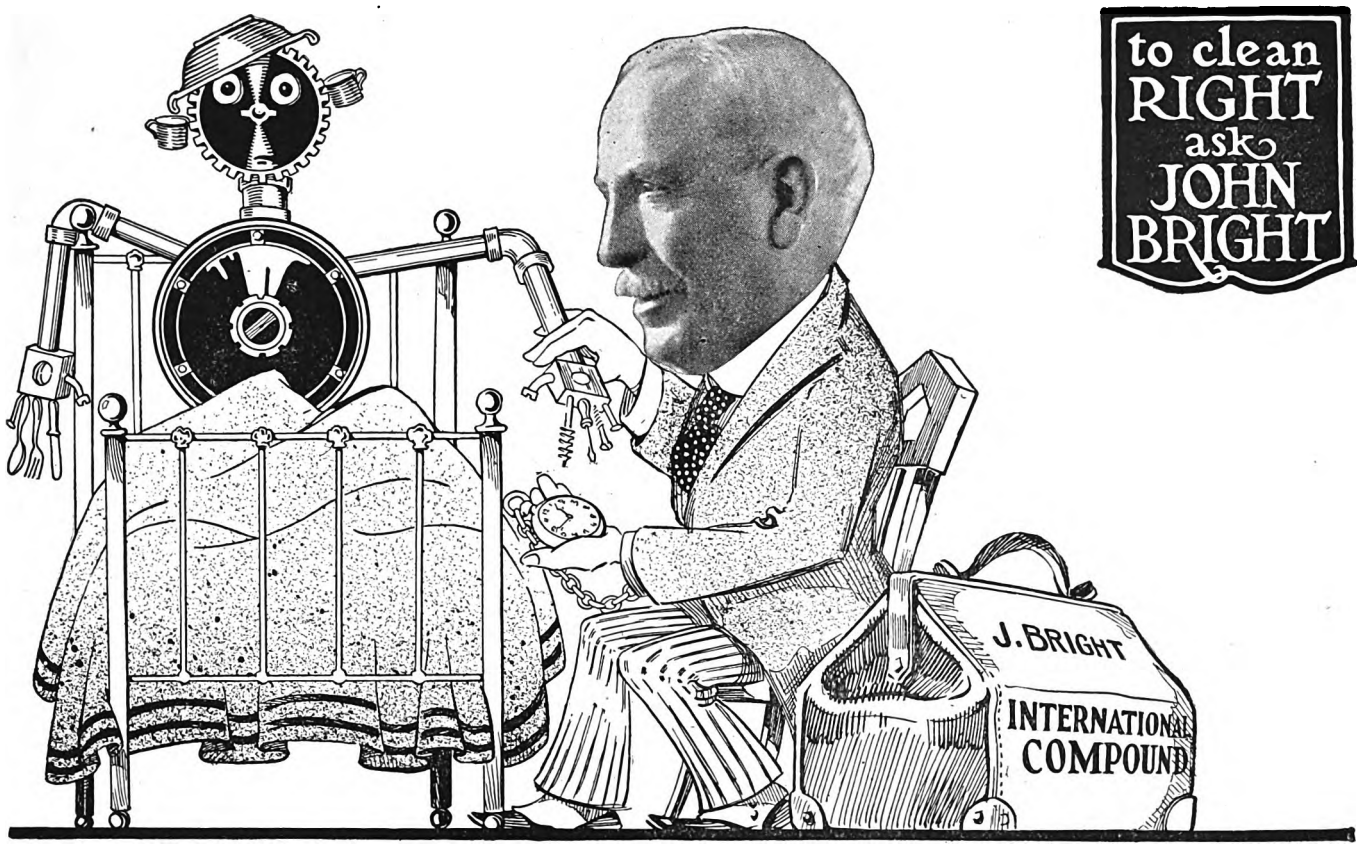
The real "cause" of the business, of course, is first found among those most vitally interested in the future of that business, those who will eventually get the most out of it, naturally. This intangible factor is still largely manifest in the group that stands next to the Manager, the Assistant Managers, who have a right,—or think they have,—to the ultimate inheritance of the business. Then, as we go down the line, this cause becomes weaker and weaker just as the hope of ever being a manager becomes more of a barren ambition than a living possibility.

Now change the word "cause" to "ideals,"—the "cause" of your business, the "ideals" of your business, *your ideals.* Are you, yourself, sold to those ideals? If you are, your next job is to sell them to the executives who are to come after you. The manager with the true ideals, with a loyal line of officers enthusiastically back of those ideals—providing, of course, the ideals are right—need never worry about employer-employe problems, nor in the final analysis, about his business making money, his deserving and attaining an enduring and an honorable name.

The closer the mutual interests of workers and employers, the more obvious the fact to the humblest employe that energy, sustained and unfaltering, intelligent service and zeal, are appreciated by men of largeness of heart and understanding, and will continuue to be appreciated tomorrow, next week, next month and next year. Thus, the more solidified their loyalty, the surer the lasting success of the business. No one now seriously questions that. In American business life that assertion may be accepted as a truism. Proofs of it abound in every American city. This, then being, as we often hear, the land of opportunity for all, no man, woman or child with a new idea, or in lieu of that, a resolute determination to do at all times his or her "level best," need here wait long for recognization and reward. Let that

(*Continued on Page 70*)

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Introducing JOHN BRIGHT, D. C.—*At your Service*

I SUPPOSE you are all curious to know what the "D. C." stands for, eh? It is Doctor of Cleaning and my twenty years' experience in solving cleaning problems and perfecting scientific compounds has so fitted me to cure cleaning ills that people have given me the title.

Yes, I realize this sounds mighty egotistical, but you see I have finally persuaded the advertising men to let me talk "straight from the shoulder" to people interested in industrial cleaning. So I am talking frankly in an effort to give you facts.

For years I have been successfully treating the cleaning troubles of metal goods concerns, railroads, automobile manufacturers, dairies, textile mills and many others. My company manufactures more than forty cleaning compounds, one of which will suit your individual needs. And it's part of my job to tell you which one to use, after you tell me what your trouble is.

You don't have to juggle around with one or two cleaners trying to make them clean everything. That's wasteful and unnecessary.

If you will write me in detail about your cleaning operations, I will send you enough of the proper cleaner to thoroughly convince you that INTERNATIONAL CLEANERS will do better work at less cost than the cleaner you are now using. If my cleaner does not do this, return what is left after you have tried it, and you won't owe me a cent. That's my proposition. Fair enough, isn't it?

Internationally yours,
John Bright

International Products
IC
International Chemical Co.

INTERNATIONAL CHEMICAL CO.

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ELECTRIC TRACTORS

Transport Tons

where hand trucks move pounds. They reduce expense in all your departments.

Request Catalog 1208.

The Elwell-Parker Electric Company
Cleveland, Ohio



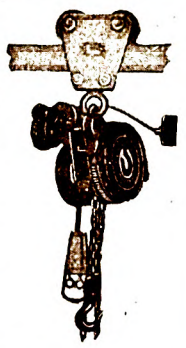
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The Motor Driven Chain Hoist

The MOTORBLOC is hung up like any chain hoist.
When connected to the nearest circuit, it is ready for work without any Engineering Preliminaries.

Light—Portable—Steel-Strong

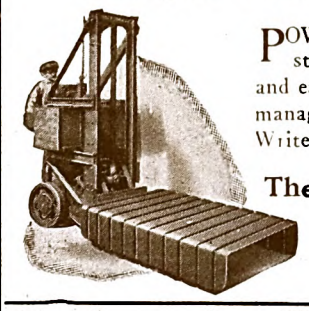
"Hook Up, Plug In, Let's Go."
Write for full details



MOTORBLOC CORPORATION
Summerdale PHILADELPHIA

POWELL Pressed Steel Platforms

Adapted to all Hand and Electric Lift Trucks



POWERFUL Lift Truck Platforms of one-piece, seamless steel construction that last a lifetime. They create speed and ease in handling loads. Workmen like to use them and managers appreciate their long life and low cost.
Write for prices.

The Powell Pressed Steel Co.
Hubbard, Ohio.
Suburb of Youngstown, Ohio

For lower handling costs—

Northwest Cranes—with clamshell bucket or grappling hooks; as a pile driver.
Northwest Draglines—for drainage jobs, excavating, grading.
Northwest Shovels—with only one motor—gas or electric.
A complete line proved in service. Patented crawler base provides

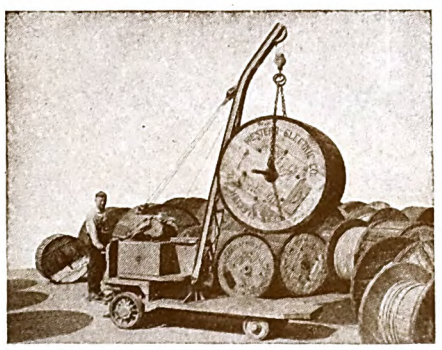
Unequalled Mobility

NORTHWEST ENGINEERING CO., Chicago



The Northwest Crane, shown below, cuts handling costs in a thousand and one operations. Write—

Northwest Crawler Cranes—Draglines—Shovels



Easiest Way to Handle 3,000 Pound Pieces

is on Electric Industrial Trucks equipped with **REVOLVING CRANES.**

Bulletin 51 tells how.

The Elwell-Parker Electric Company
Cleveland Ohio

HANDLING

(*Continued from Page 68*)

seed be implanted as a conviction in the breast of the worker.

Faith goes with good works along all lines of labor in this open, free Democracy of ours. Enthusiasm and intelligence go hand in hand toward great material as well as spiritual ends. In these surging, thronging cities energy begets energy and unselfish examples always tend to become contagious. It spurs on, stimulates and inspires hope and ambition. So as our Cambridge poet says:

"Let us, then, be up and doing,
With a heart for any fate,—
Still achieving, still pursuing,
Learn to labor and to wait."

Handling 3000 Tons of Mail a Day

(*Continued from Page 21*)

end of the line, thus effecting a saving of close to an hour on each motor truck load.

The first step in the system begins at the large business houses or mail order concerns. The mail is loaded into six or eight of the small tilting trucks and the latter are conveyed by a large motor truck to the mail terminal building. Arrived there, the tilting trucks are pulled out of the motor truck, coupled together in trains and attached to an electric tractor, which hauls them to a trough or pit, 50 feet long and 45 inches wide, in the floor. Immediately below is a 42-inch, 4-ply feed belt. A bumper at one side of the pit marks the route for the train of tilting trucks and prevents it from slipping into the pit. As the train passes along, employes tilt each truck and the contents slide to the feed belt below. The belt is traveling in the opposite direction from that of the train, and thus it clears each truck load in time to receive the next load.

Conveyor No. 1, (shown at the right in Fig. 1.) is approximately 100 feet long, while conveyor No. 11, (shown at the left in the same illustration) is 50 feet long. These conveyors travel 40 feet per minute and carry all the pre-canceled mail going through the building. The width of the belt is 42 inches and it has a carrying capacity of 15 pounds per square foot. This would amount to approximately 25,000 pounds, or 12½ tons, per hour. These two conveyors deliver to inclined conveyors numbered 1 A and 11 A (see Fig. 3) which run up to the second and third floors, respectively, and terminate in what is called the Primary Separation Unit No. 1 on the third floor. From the second pit mail is delivered onto a 44-inch incline belt which, in turn, deposits it on the third floor. This belt acts as feed belt for Primary Separation Unit No. 2, which adjoins Unit No. 1, there being a common tier between them.

The separation unit on the third floor, which is 130 feet long, takes care of the mail for the states of Iowa, Indiana, Michigan, Wisconsin, Illinois, and Ohio. The sorting clerks stand on a platform extending between the two tiers of belt conveyors (there being three feet of space each for forty men), pick from the feed belt the packages intended for the different states, and throw them onto the various belts specified for those states. Canvas flares at the sides of the belts prevent packages from going onto the floor, at the same time deflecting packages to belts and breaking their fall. A separation unit on the fourth floor takes care of the belts assigned to the states of Missouri, New York, Kentucky, etc. The primary separation system on this floor has the same number of belts as the system on the third floor, the only difference being that the fourth-floor system is 60 feet long whereas the third-floor system is 130 feet in length.

The final separation and classification of all mail handled by the terminal forces is made at tables on the second, third, fourth and fifth floors where the mail is placed in sacks and properly marked ready for delivery to the Union station forces on the track floor or the basement, or to the street vehicles on the street floor for delivery to various parts of the city or to other railway stations. Such mail, in sacks, is handled by means of tractor trains which take the sacks direct to mail cars.

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The movement of the sacked mail from the floors mentioned to the track or street floors is accomplished by carrying the sacks, on balanced type trucks, to holes in the floor leading to longitudinal ceiling conveyors directly below these floors. There are twenty of these ceiling conveyors in all, five to a floor, which extend practically the entire length of the building. The mail is dropped onto the ceiling conveyors through openings, or chutes, in the floors. There are 60 of these chutes, 24 to 30 inches in size, to a floor and they are uniformly spaced apart. Since it is not desirable to have the mail sacks drop the full vertical distance of 7 feet from the floor level to the ceiling conveyors, the chutes are each given a quarter turn, an arrangement which permits the sacks to slide within three feet of the belts. Each of the twenty ceiling conveyor belts is also connected with one of five double spiral chutes placed in different parts of the building. These chutes are made of No. 12 gauge steel plates with double blades. Three of them extend to the basement, while the other two are provided with delivery spouts on the street floor.

The belting forming the conveyors is made of four thicknesses of canvas, weighing two pounds to the square yard. In splicing the belts flexible metal lacing is used. The ends of the belts are pulled together by means of clamps and the teeth meshed together with a strip of metal inserted to keep them from pulling apart. The belts travel on rollers of cold drawn seamless steel tubes which range from 3½ to 5 inches in diameter. This tubing is spot-welded to port turned steel shafts ¾ pressed steel heads that sup- inches in diameter. The shafts are fitted with renewable steel races and there are two roller bearings to each roller. This method of installation has been estimated to save some $15,000 a year in power costs, over plain bearings.

Operation of the belts is by means of motor-driven double-drive pulleys, the main pulley being 30 inches in diameter and provided with an automatic gravity takeup. The 71 separate conveyor belts are driven by an equal number of motors. Every motor has a control, there being six control boards in all, or 2 to each of three floors. There are lock buttons at every motor, and every 100 feet there are start and stop push bottons. The latter feature is provided in order to prevent the piling up of mail should a section of the train of conveying equipment in advance be shut off. The cost of this system of belt-conveyor transportation alone was half a million dollars.

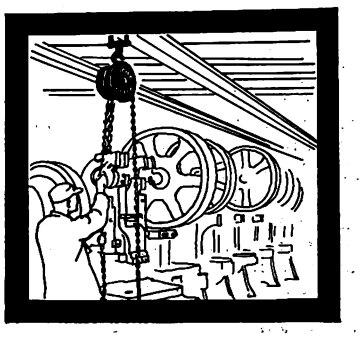
It is the belief of Postal authorities that aircraft will soon occupy as important a place in the transmission of mail as railroads and motor trucks. With this idea in mind, provision has been made by which the roof of the new mail terminal building can be converted into a landing and starting place for airplanes and possibly even dirigibles. A number of foreign governments interested in the possibilities of aerial mail have already requested from the United States full information on this feature of the new station, while others are studying the station as a whole with the idea of installing similar parcel post facilities in their countries.

Underground Coal Storage

STORAGE of coal underground at the mines is suggested by Director H. Foster Bain of the Bureau of mines as a practical step toward the accumulation of those reserves of fuel which are necessary to stabilize industry and to protect the domestic consumer in periods of acute coal shortage, such as the country has recently undergone.

The seasonal demand for coal can to some extent be met by storage, but this must be done by the consumer or by some distributing agent operating between him and the mine, says Dr. Bain in a report made to the United States Coal Commission. At the mines the best place to store coal is in the ground and with unimportant exceptions it is not feasible to provide more than a limited amount of

MATERIAL



Chain Hoists for All Purposes



¼ to 30 Tons Capacity

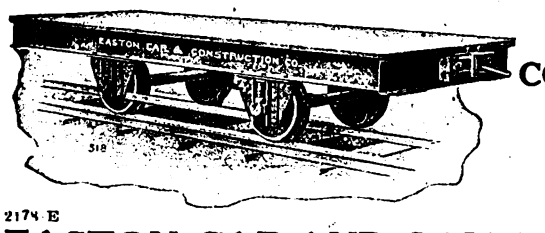
Safe Dependable Economical

WRIGHT MANUFACTURING COMPANY
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COMPLETE INDUSTRIAL RAILWAY EQUIPMENT

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Robins Systems
complete with all accessories for the rapid and economical handling of bulk materials.

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BRADY
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Save hundreds of dollars. BRADY STEAM JET ASH CONVEYORS are saving money in hundreds of plants. Tell us your problem; send for our "Book of Facts."
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Also manufacturers and designers of Pneumatic Conveyors for handling granular and pulverized materials of all kinds.

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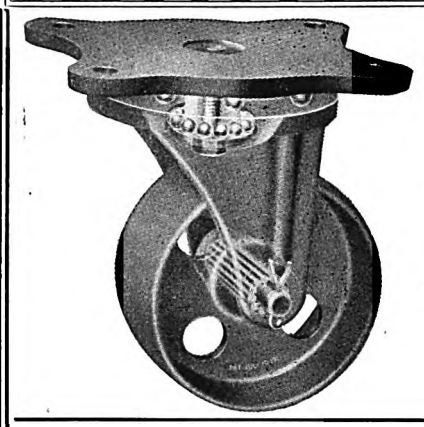


Portable Belt Conveyors—Truck Loaders
Catalog on Request
THE GEO. HAISS MANUFACTURING CO., Inc.
146th St. & Canal Place, New York

HANDLING

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MATERIAL



AMERICAN INDUSTRIAL
Frictionless
DOUBLE BALL and ROLLER BEARING CASTERS

The American Caster swivels on balls, rides on balls and rolls on rollers.

ABSOLUTELY WILL NOT drag sidewise. Rigid casters to match.

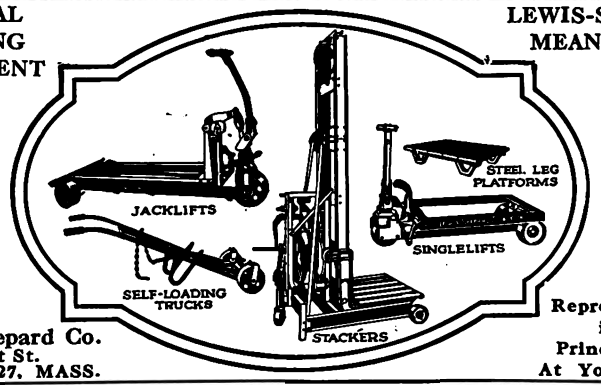
If you are not getting satisfactory service from the casters you use on your industrial trucks or product,

Try the AMERICAN.

PHILIP A. HELLER & SONS
213 West State Street
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MATERIAL HANDLING EQUIPMENT

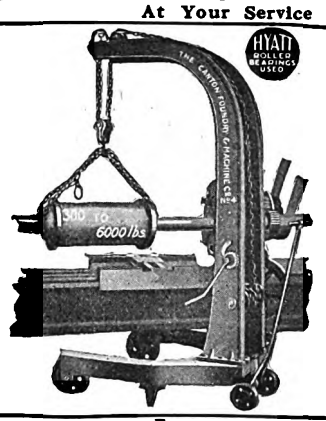
LEWIS-SHEPARD MEANS LABOR SAVING



Made by
Lewis-Shepard Co.
582 E. First St.
BOSTON 27, MASS.

Representatives in the Principal Cities At Your Service

CANTON Portable Floor CRANE



Makes One Man's Time Worth Six

Truly "The Handiest Tool in the Shop." Goes where nothing else can reach. The CANTON will lower your lifting costs. *Send for catalog* E 15

CANTON FOUNDRY & MACHINE CO.
CANTON, OHIO
Permanent Exhibit Salesroom, Grand Central Palace, New York

"Handling" is the wrong word

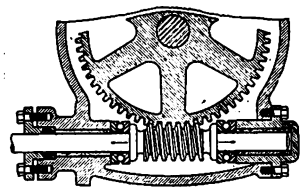


when applied to Dow Conveyors. *Handling* suggests *carrying by hand* whereas the very purpose of Dow Conveyors is to dispense with costly human effort in moving parts and finished products from one place to another. Dow Conveyors (Gravity and Power) do away with porters and enable the skilled mechanic to devote *all* of his time to production instead of intermittently walking the floor. Many manufacturers are not aware of the time-labor-and money-saving ability of Dow Conveyors. The facts are yours for the asking. The Dow Co., Incorporated, Louisville, Ky.

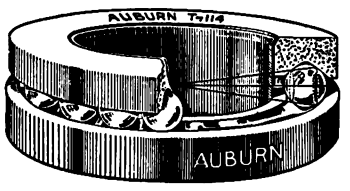


DOW CONVEYORS

WORM DRIVES OPERATE MORE SMOOTHLY WITH **AUBURN THRUSTS**







Reduce back lash, increase the life of both Worm and Gear, and get smoother operation by using AUBURN BALL THRUST BEARINGS. Tell us your problem and get the Auburn Answer. Ask for Catalogue.

STEEL BRASS AND BRONZE BALLS
AUBURN BALL BEARING COMPANY
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HANDLING

storage above ground.

The anthracite companies established near points of consumption a system of great storage piles which were valuable balance wheels to the trade and have facilitated that steadiness of operation which distinguishes anthracite from bituminous mining. Large scale storage of bituminous coal has been less practical because the uncertainty as to future price—a result of the excess capacity of the mines and the keen competition—has deterred companies and individuals from making the necessary investment. The same factors tend to discourage individual consumers from storing in summer, coal that will not be burned till winter. In periods of advancing price or of anticipated shortage, however, as much as 60,000,000 tons of bituminous coal has actually gone into storage. This is enough under normal conditions to stabilize the industry and also to contradict effectually those who doubt the technical feasibility of storing soft coal.

With proper selection of the coal and due attention to modest requirements as to methods, it is entirely practicable to store large quantities of most coal at moderate cost, continues Dr. Bain. The risk is in the uncertainties as to future price, as the mine and railway equipment of the country is extensive enough to allow industry, except under unusal conditions, to obtain adequate supplies direct from the mines. Coal shortage and car shortage is a local matter in normal years. The nation has put men and money into coal mining and the railways to meet peak loads rather than provide a less amount of capital for coal storage and so insure steady and economical operation. The whole problem of coal storage has recently been reviewed by H. H. Stoek, consulting engineer to the Bureau of Mines, and a report is being prepared which will place the facts at the disposal of all persons interested.

The possibility of devising a use classification that will permit a wider pooling of coal is also suggested by Dr. Bain. "Such pooling would relieve the pressure on docks, terminals, and railway equipment," he declares. Most users of coal lack facilities for selecting the grades best suited to their needs, and most coal is sold on its name or on the reputation of the operating company or local dealer. A good name is a valuable asset in business and when one has been built up it should be preserved as a public benefit, but this should not be incompatible with the perfecting of some system whereby a buyer could be assumed of getting on delivery a definite measure of predetermined value in his coal. A system that would justly penalize dirty coal and would assure each grade selling on its merit would be in the public interest. If such variable products as cotton, potatoes, and wheat can be satisfactorily graded for delivery in the public markets it would seem not too much to ask that a similar system be applied to coal. A basic difficulty is that of sampling and measuring without undue expense a commodity handled in such quantity. It is much more difficult to sample coal by hundreds of trainloads than to grade potatoes by the box or even the carload. In coal, too, there is the fundamental difficulty of the wide range in sizes as compared with grains of wheat or corn. Provisional systems have been worked out and are being regularly applied by the Bureau of Mines in supervising purchases of coal for the Federal fuel yard in Washington, the Isthmian Canal Commission, and other Government establishments. Much time and thought have been devoted to the subject and further studies are under way. The general desirability of simplifying the marketing and transportation of coal, and of establishing grades responsive to use, with further provision of effective and not too expensive methods of testing the coal flowing in commerce, is undoubted, and it is to this end that the Bureau of Mines is working.

"In the long run it is believed that as technical and economic conditions in the industry progressively improve, the social and labor conditions will largely care for themselves."

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From U. S. Bureau of Mines.

Washington, D. C.—Gasoline production in the United State attained a near-record in October, the month's output of 566,278,689 gallons having been exceeded only by the figures for last July, when but 3,400,00 gallons more were refined, states the Bureau of Mines. The October production represents an increase of about 30,000,000 gallons over the September output, and is 28 per cent greater than the gasoline production for October, 1921. Domestic consumption of gasoline decreased about 18,000,000 gallons from the September consumption figure, but was about 7.5 per cent above the figure for October of last year. Exports and shipments to insular possessions amounted to approximately 43,000,000 gallons. Stocks of gasoline on hand November 1 were 723,584,062 gallons, an increase of 33, 500,000 gallons during the month.

The number of refineries reporting to the Bureau of Mines during October was 310, with a total indicated daily capacity of 1,844,540 barrels. These refineries were operated at 86 per cent of their capacity.

Production of kerosene in October amounted to 215,203,459 gallons, an increase of 8.72 per cent over September. Exports and shipments of kerosene to insular possessions amounted to 84,331,437 gallons, an increase of 16.94 per cent, which largely accounts for a decrease of stocks amounting to 5.29 per cent. Stocks on hand November 1 were 256,259,432 gallons.

Total production of gas and fuel oils reported to the Bureau of Mines during October was about 4,000,000 gallons above the September figure, and amounted to 921,606,114 gallons. Stocks of these oils on hand November 1, were 1,368,748,880 gallons, an increase of 4,000,000 gallons. Both the output and stocks of gas and fuel oils for October, 1922 were 10.54 per cent above the figures for October, 1921. Exports and shipments to insular possessions during October amounted to 63,315,723 gallons. Bunker oil laden on vessels engaged in foreign trade amounted to 114,100,728 gallons.

The Ironworkers

They call me an Alpine climber, but I *build my* peaks to the sky,
I am really a two-legged spider, spinning my web on high.
Short time have I to drink the colors that bubble in the wells of morn,
But I have seen dawn's trembling rose, and its clustered violets born.

Below me pigmies in the street pursue their crawling way,
Their feet must hug the solid earth, while I with danger play.
I know the whistle of the roystering wind, and thrill to its reckless voice,
For I am a daring chit of the air—I climb, and my feet rejoice.

I manage the upper rungs with ease, and sway like a weather-vane,
I bump my head up against the clouds, as smart as an areoplane.

There are sightless flies in the mines of coal that are born of the germs of gloom,
But I am bred of the sun-washed roofs, and I sometimes drop to doom.

Before me curves the world of work,—a crowded canvas spread,
Each rivet hammered home with air to me means daily bread.
In cold or heat my muscles dance from a wine of courage strong—
An eagle thrives beyond the clouds, and I trail the eagle's song.

And whether the age sweeps on to dust, or points to the nearest star,
My horn's unslung from the naked heights, where the fearless seekers are.
For men are stirred with the urge of wings—they build, they climb, they fly,
And I take clean pride in spinning my web between the earth and sky.

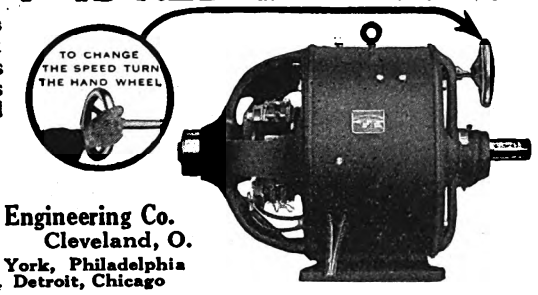
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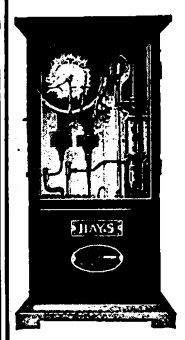
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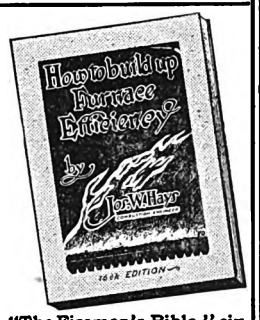


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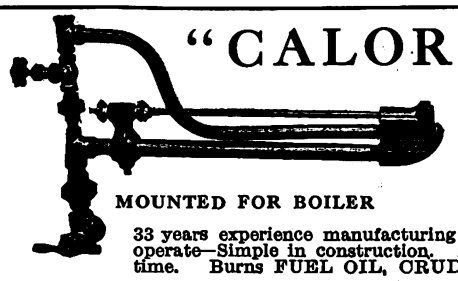
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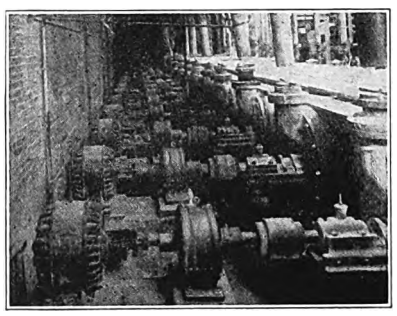


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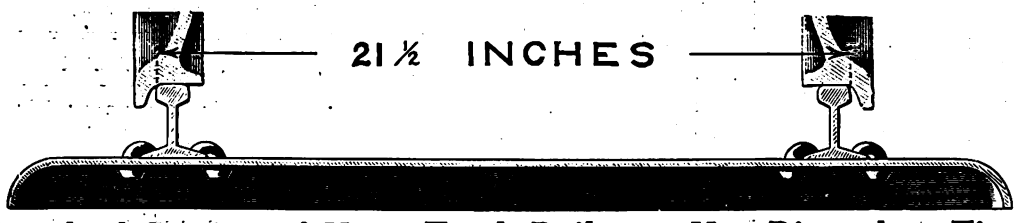
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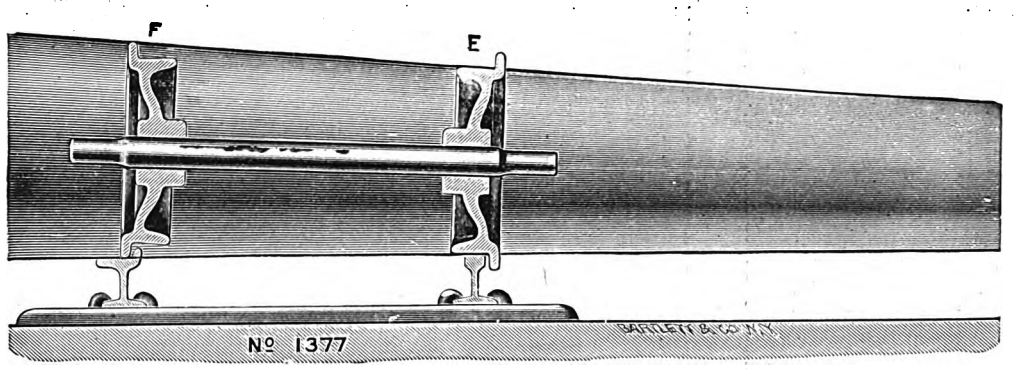
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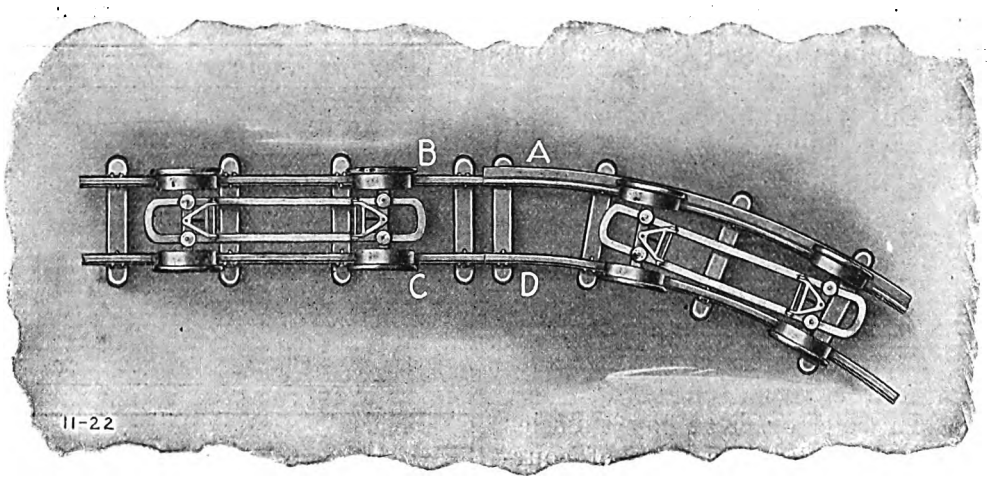
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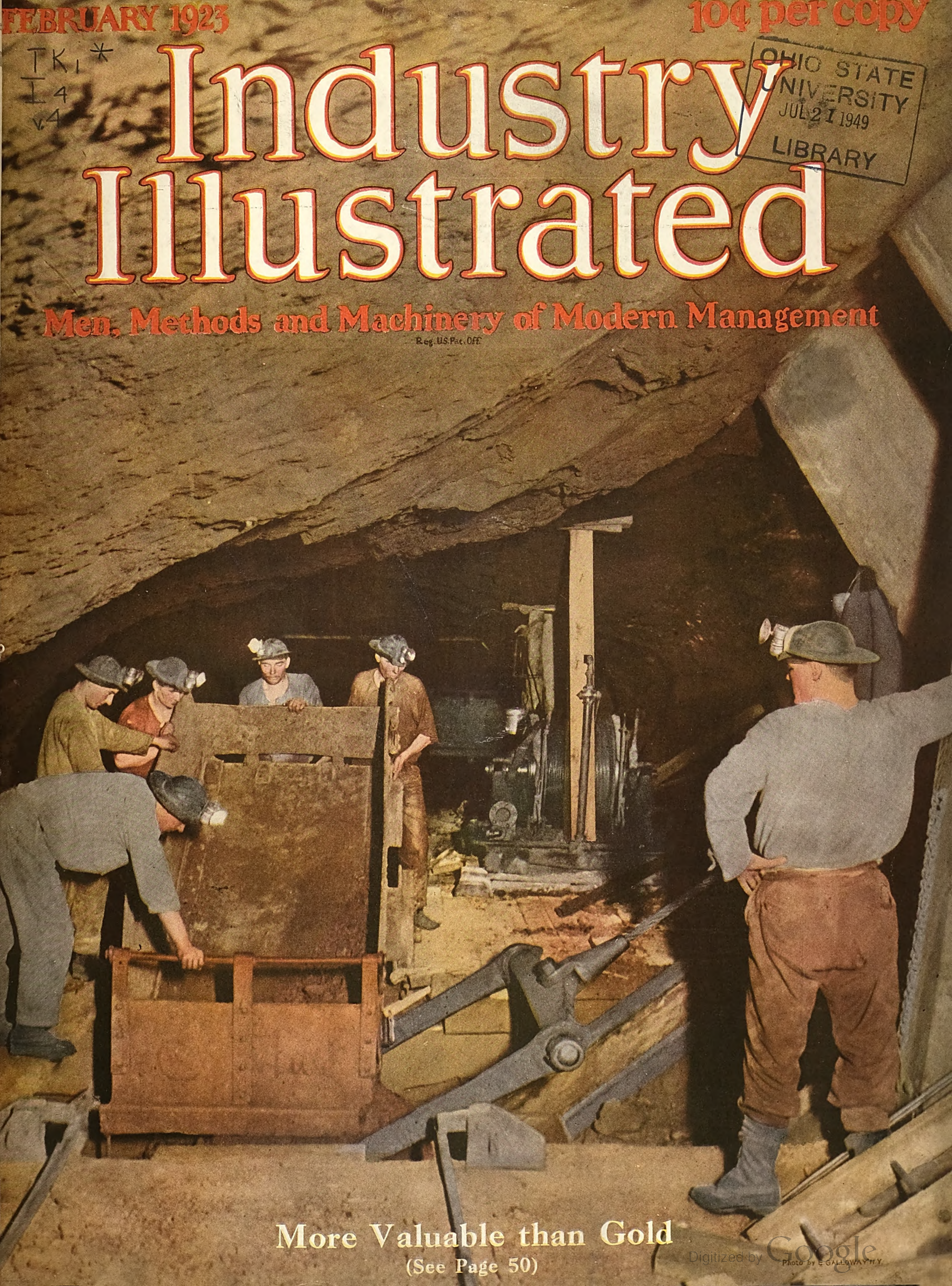
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More Valuable than Gold

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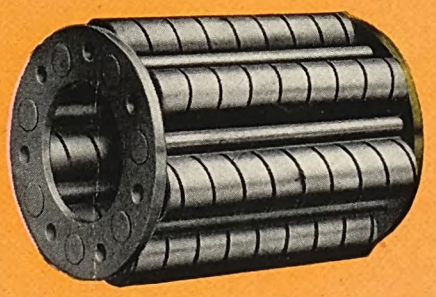
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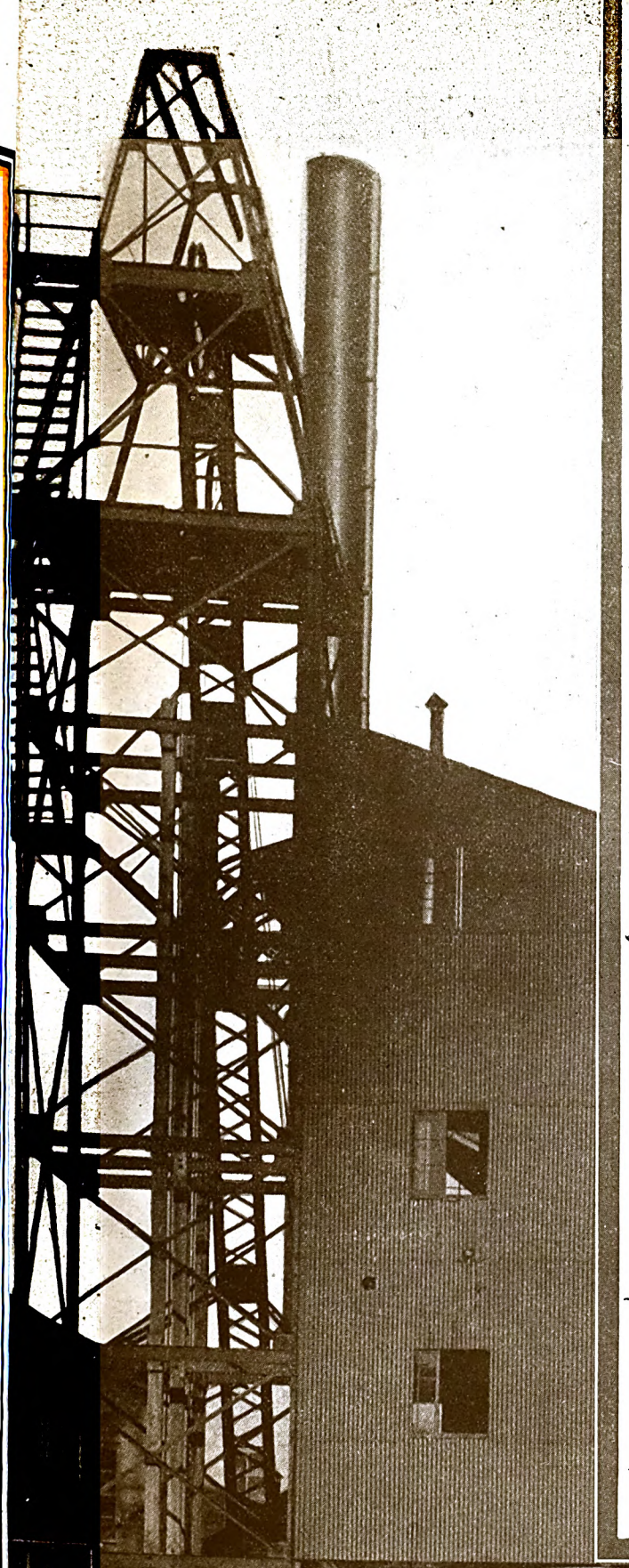
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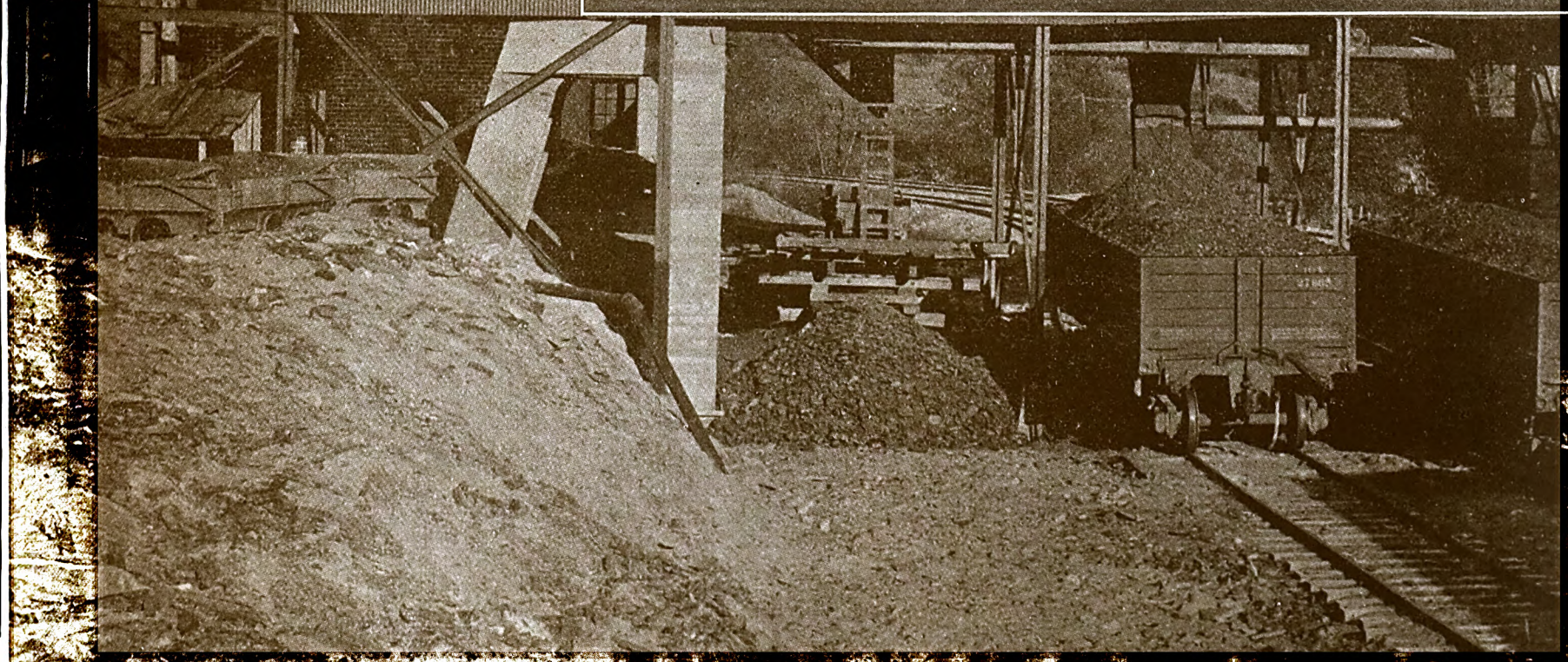
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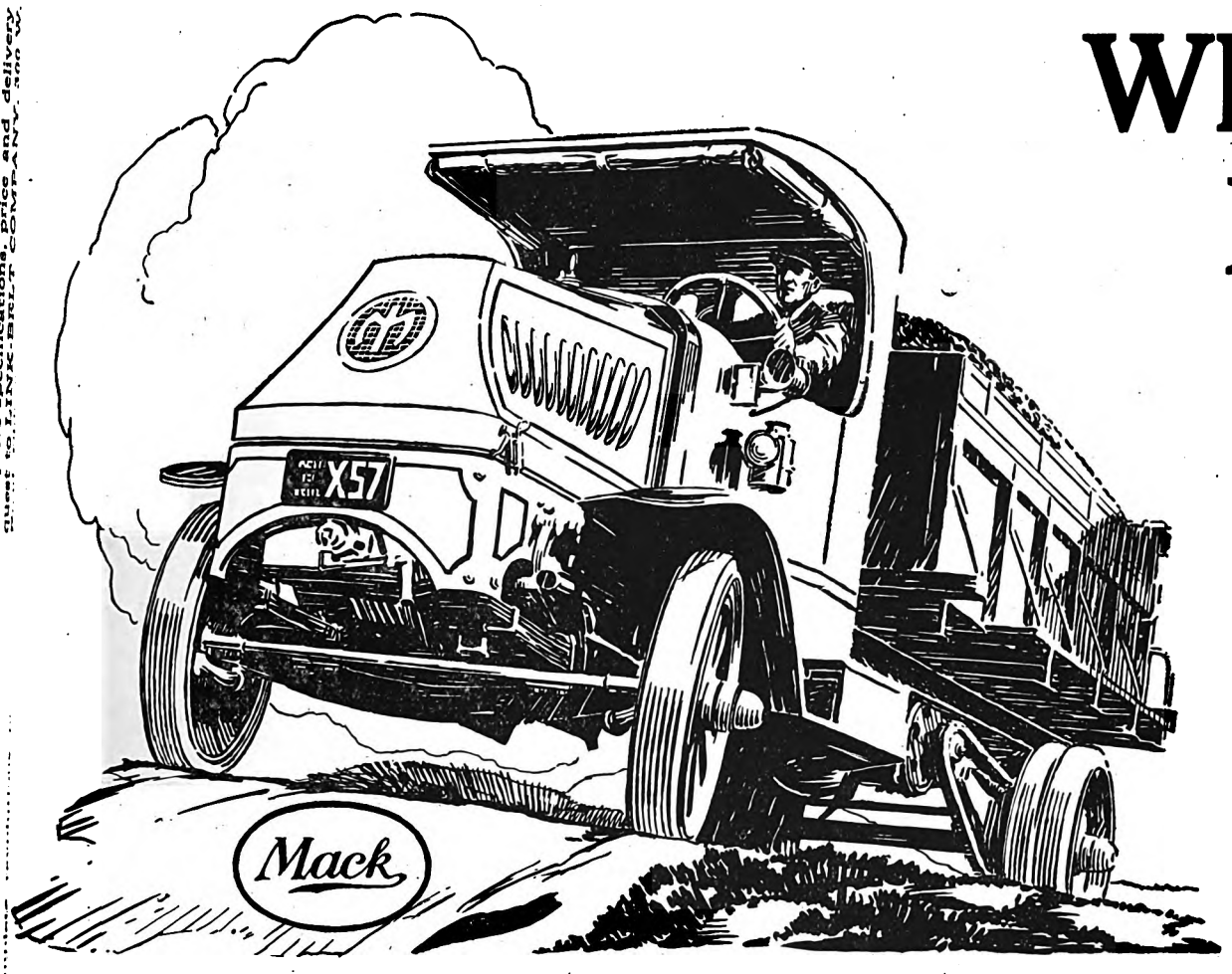
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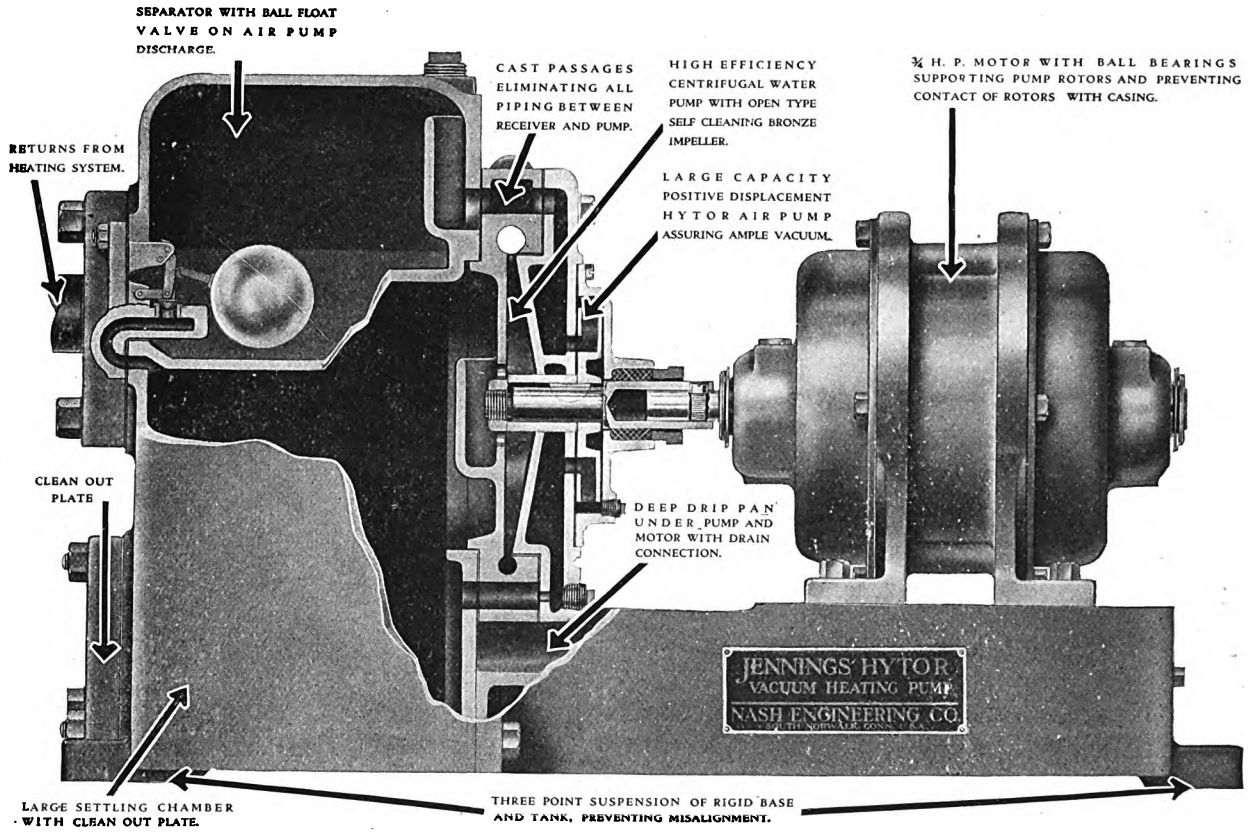
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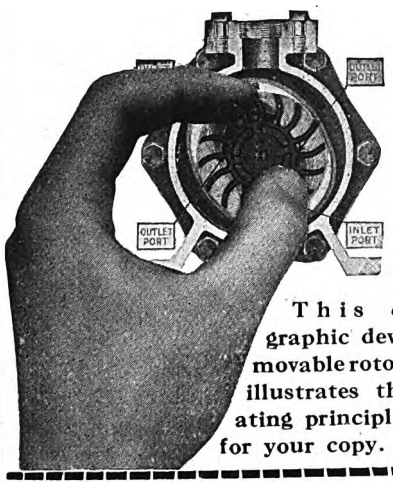
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EDITORIAL

Coal Cost, Plus

IT has been known, for a number of years, that there were some things wrong with our coal industry; but how many things, and how thoroughly wrong, we are only now beginning to appreciate. The first report of the United States Coal Commission, made public on January 15, in spite of its restrained language, discloses a situation that is a stinging reproach to our much-vaunted American efficiency.

In 1910, the average miner's daily output of bituminous coal was about 3½ tons. In 1921, partly through the increased use of machinery, his daily output was 4 1/5 tons—*an increase of twenty per cent.* Bearing that in mind, it is somewhat startling to learn that in 1910 there were less than 556,000 mine workers, who produced 417 million tons of coal; while in 1921 it required 663,000 mine workers to produce 416 million tons! The explanation for this apparent contradiction lies in the fact that the average bituminous mine worked 217 days in 1910, and only 149 days in 1921.

Naturally enough, it is not the miner's fault that he gets but 149 days' work in a year; nor is it unnatural that he wants his pay to cover a full year's living costs. But it does not by any means follow that the coal consumer should have to pay 300 days' wages for 149 days' production.

When the bubble of post-war inflation collapsed, the collapse hit most industries both suddenly and hard. Skilled labor in specialized lines had to seek employment in alien lines; factories which could not meet the new conditions had to quit; executives who could not produce results had to step down. Recovery, in these industries, has been by the slow, painful but effective process of reducing costs and eliminating wastes.

In the coal industry, however, neither mine workers nor operators have shown any willingness to face the truth. There is admittedly over-expansion in the coal mining industry; we can use the production of but 5,500 of the 8,000 mines in operation; there are some 200,000 too many mine workers in the field. It is this condition that has reduced the average mine working days to 149 out of a reasonable 300 per year.

Is it any greater tragedy for a mine operator to admit his inability to meet competition, close down his mine, and engage in other work, than it is for a manufacturer of clothing or automobiles? If thousands of mechanics, skilled in special trades, were able to readjust themselves to other work, for which a demand existed, cannot the 200,000 excess mine workers do likewise?

There has been much pressure brought to bear on the Administration, to lower the bars on immigration; the argument being that there is a shortage of labor in many industries. Yet, right here in the coal industry is a surplus of some two hundred thousand men for whom, economically speaking, there is no work.

By all means eliminate profiteering, attack the problems of storage and transportation and all the other factors contributing to the unreasonable price of coal. But if we stop there, we merely postpone the inevitable. Coal will never be available at a fair price until it is produced as any other commodity is produced. The coal industry will continue to impose an unjust burden on all industry, and on the nation, just as long as it continues to carry a dead load of fifty per cent. too many mines and fifty per cent. too many workers.

Until that millstone is removed from our necks, we shall continue to pay an excess charge for everything we eat, everything we wear, everything we use; an excess charge for our transportation, heat, light, and power; an excess charge due, not to natural factors, but primarily the result of a vicious combination of inefficiency, selfish greed, and lack of even rudimentary common sense in the mining and distributing of our coal.

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Fitting the Small Steam Turbine into the Factory

By John Herbert

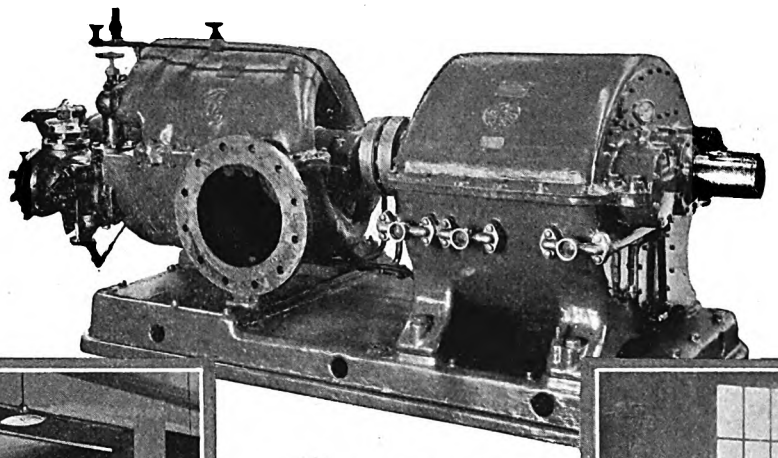
THE modern factory executive in considering the question of power and heat or, going back a step further, the burning of fuel, thinks along quite different lines from those of his predecessor of ten years ago. And he thinks more logically.

But the average man does not begin to think logically nor exhaustively upon an unfamiliar subject until he comes to realize that *not* to do so is costing him money. It is not enough that it *is* costing him money—he must *realize* that it is. To drive home this realization as a rule requires some sort of shock or at least some occurrence or pressure that will force one out of a previously developed mental rut.

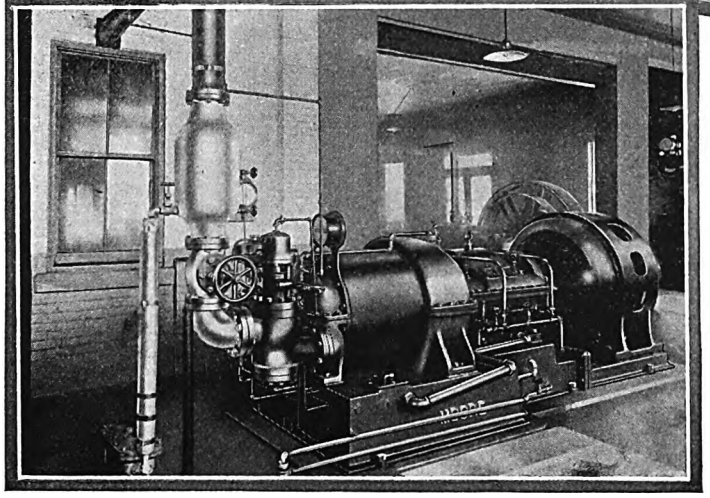
In the case of the factory executive and in connection with the generation of power, this shock or pressure has been applied by the outrageous increase beyond all reason in the price of fuel. The principal fuel for power is coal, and coal, as it happens, is the only commodity that has not receded in price from its war-time peak level. All of the other principal commodities and necessities have come down one hundred or more *points* on the relative price scale, but coal in some mysterious manner seems to be able to resist laws of deflation that have compelled all of these other things to come to more reasonable price levels.

It is for this reason that power costs stick out so prominently in the executive's daily, weekly or monthly cost records that he cannot fail to note them. One of an executive's principal jobs is to scan cost reports and to detect items which show a tendency to grow out of proportion to the growth of the business. So it could not help but happen, with power costs tripled and quadrupled over the pre-war normal, that the factory executive should have his mind forcibly directed toward ways and means of offsetting, if possible, this increased cost.

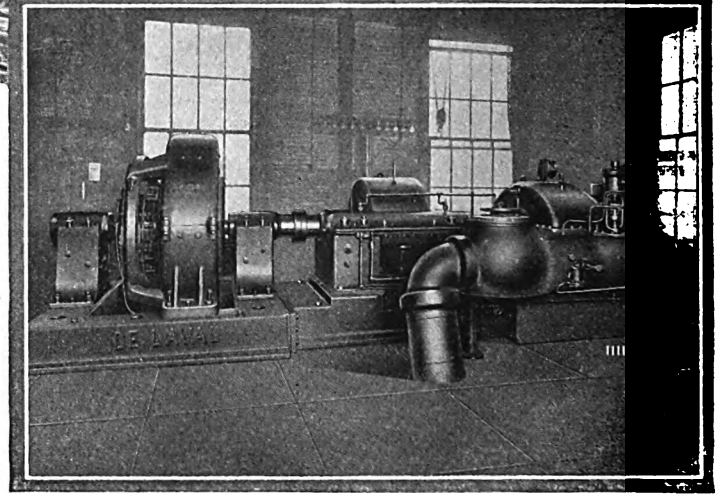
So a good deal of attention has been directed toward the



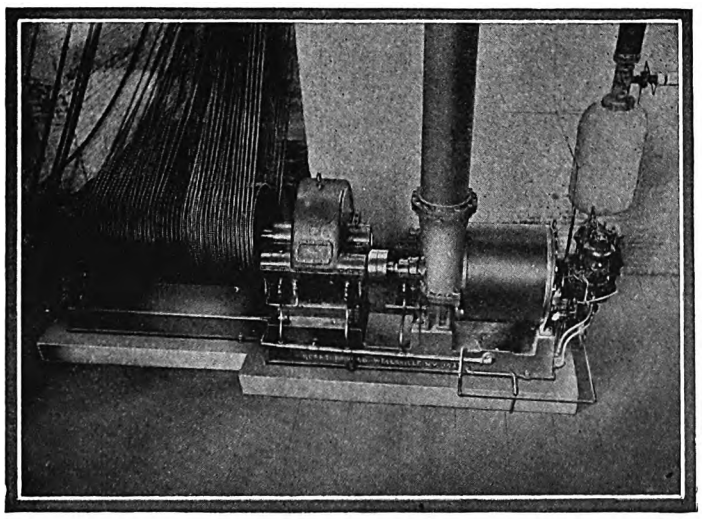
Except for fan and blower service, the usual turbine installation of today includes a reduction gear, thus enabling both turbine and driven apparatus to realize their maximum efficiency.



For the small factory and from the standpoint of simplicity, compactness and reliability, it is hard to beat a turbo-alternator as a primary source of motive power. That shown above is of 320 kw. capacity.

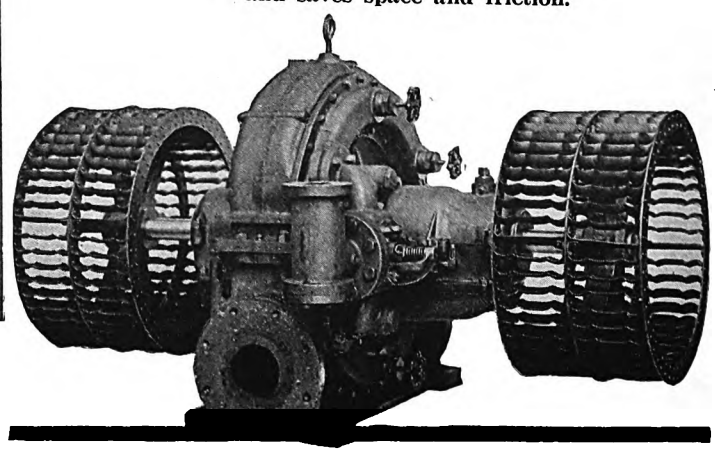


This 500 hp. pressure stage turbine produces power as a by-product of reciprocating engine exhaust, expanding this steam to condenser pressure. This additional power is obtained practically without cost aside from investment.

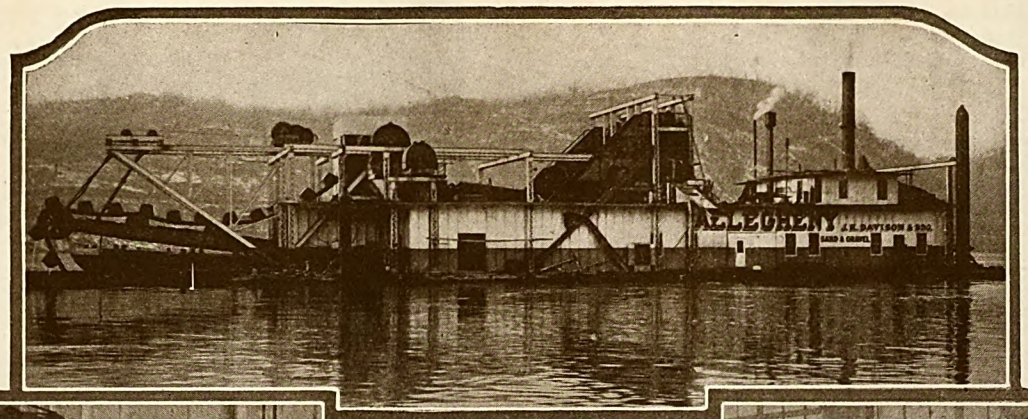


Rope drive is largely used in the southern textile industries and in other places where its qualities are required. One of the oldest forms of drive, it is nevertheless perfectly handled by the modern steam turbine.

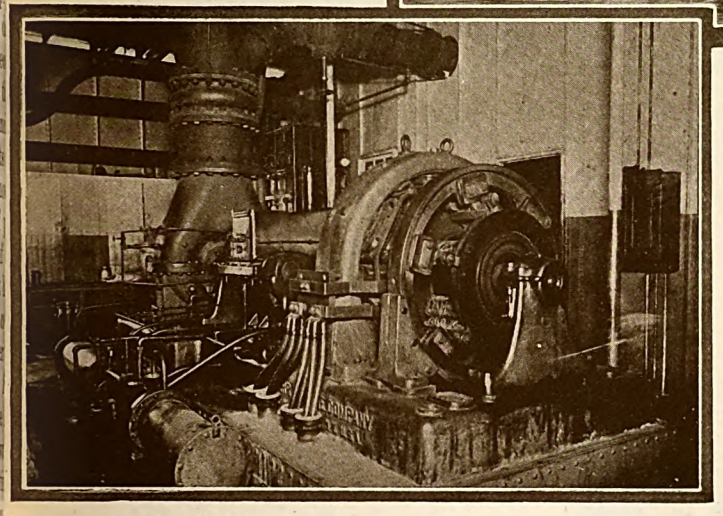
A particularly good arrangement, when it is applicable, is shown above. The direct mounting of the impellers or the turbine shaft avoids the need of fan bearings and saves space and friction.



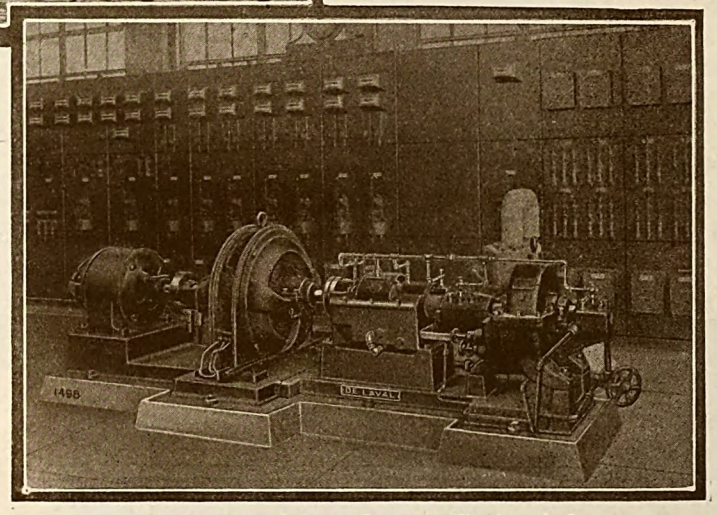
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Here is a dredging operation that is run on a real factory basis. It is the largest sand dredge on any of the inland waters of the United States. One operator with push button control takes care of dredging and separating 200 tons of sand and 350 tons of gravel per hour.



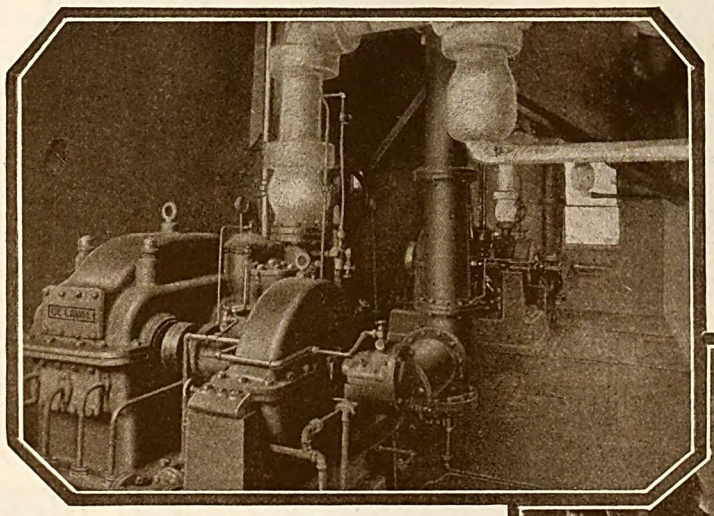
At the left—The power plant of the dredge shown above might well be found in a modern factory. All of the equipment on the dredge is driven by electric motors supplied with power from the 500 kw. turbine generator shown.



Duplex drives for auxiliaries help to regulate the amount of exhaust steam according to feed water requirements. Here a.c. and d.c. generators are coupled to a steam turbine, the d.c. generator being driven either electrically or by steam, as required.

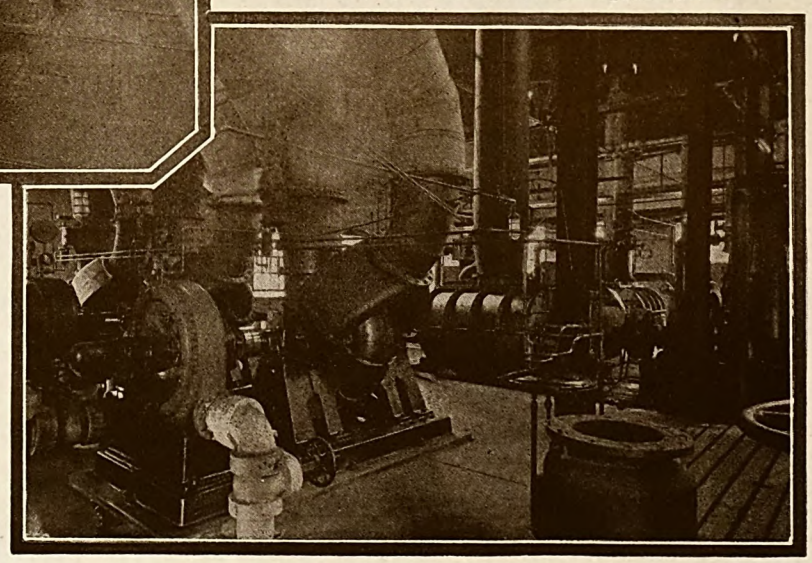
power plant and toward the methods of burning coal (which costs so much money) into power and *heat*. For today in his more logical way of thinking about these things, the executive realizes that power is really a small item in most plants, compared with the heat requirements. In other words the actual efficiency of an engine or turbine is not nearly as important a matter as is the *overall efficiency* in heat distribution. For the average steam engine or turbine takes less than 20 per cent of the heat from the steam produced in our boilers. The remainder gives us the opportunities for cost savings.

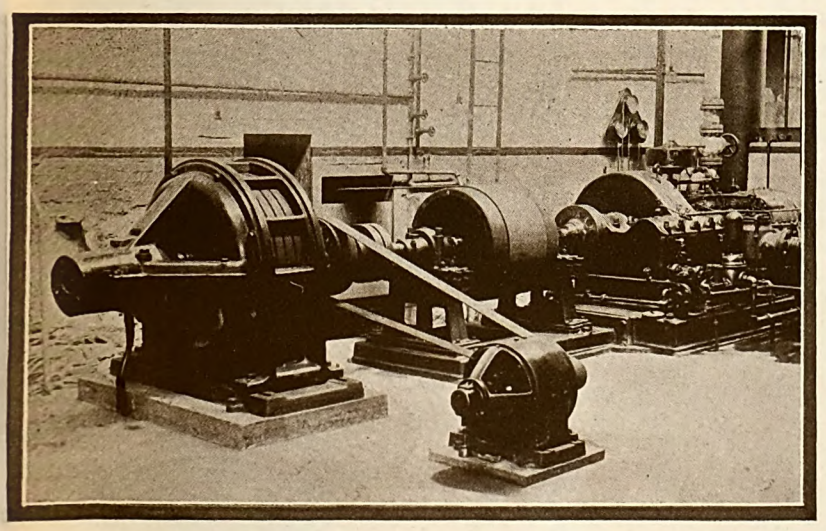
Many an engineer of the old days would spend time and money to secure a few degrees



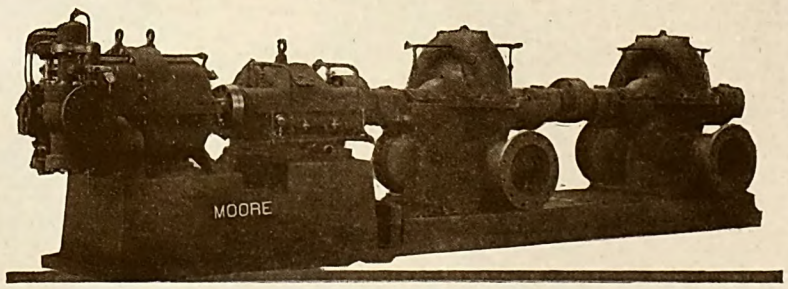
Where explosive dust or gases are likely to be encountered, steam turbines avoid the risk of ignition. Again, in a dust-laden atmosphere, short circuits are produced in armature windings. These trubines, of 300 hp. drive coal crushers at the Everett plant of the New England Fuel and Transportation Company.

Below—Three high pressure forced draft units used in a modern gas plant, are shown here. The pressure is sometimes as much as three lbs. to the square inch.





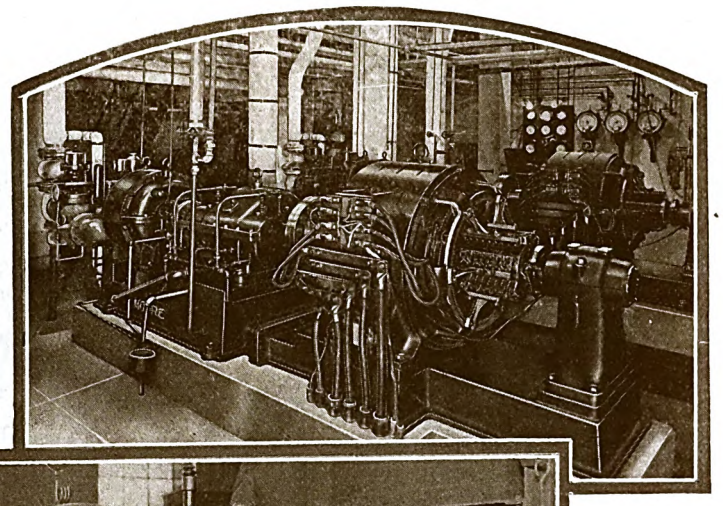
This 300 hp. turbo-generator is delivering power three ways, namely by alternating current and direct current and belt drive. It is designed for "mixed flow" operation and can also be used as an extraction turbine.

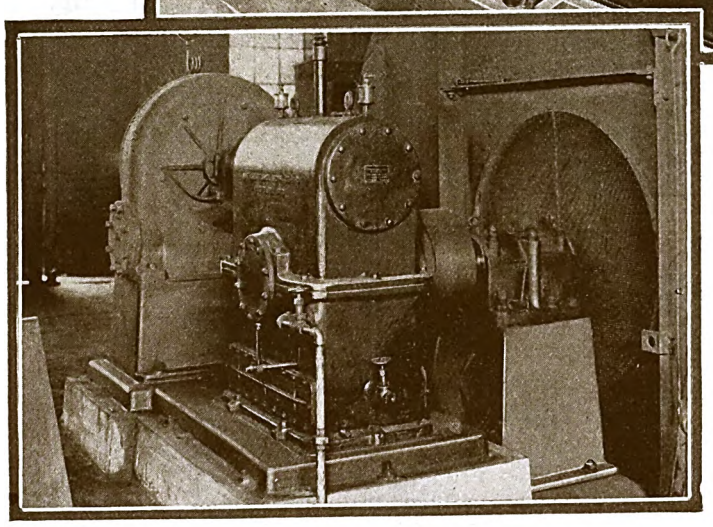


Driving two centrifugal pumps in parallel is a rather unusual duty, but not a difficult one, for a steam turbine. Synchronism in pumps' speeds is positively assured.

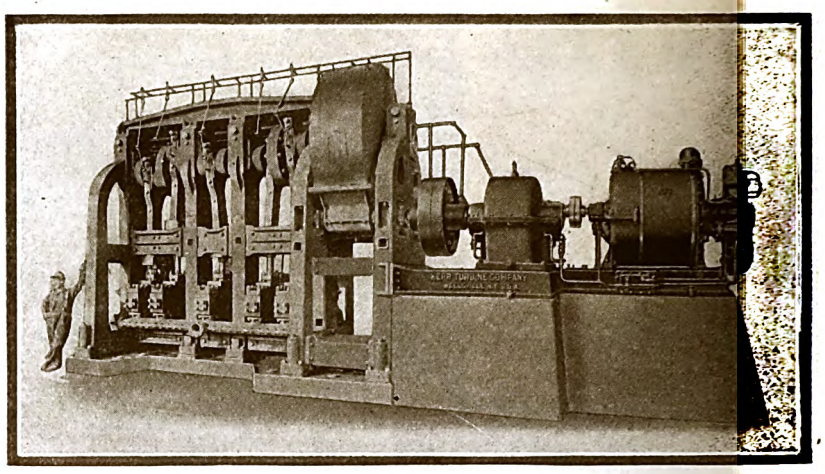
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Below—That reduction gears can be made to operate noiselessly is evidenced by this installation at the Ritz Carlton Hotel, at Atlantic City. The units are each of 200 kw. capacity.

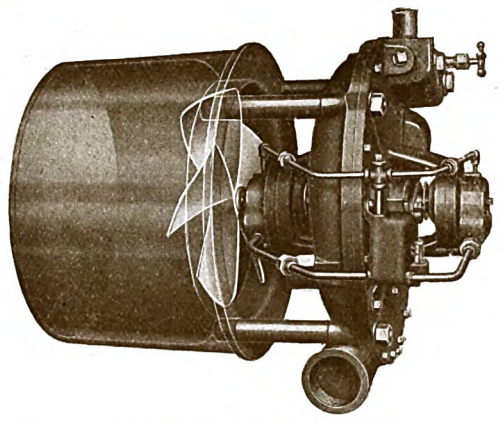




A slow speed fan being driven by a high speed turbine through the medium of a turbo-worm gear.



The above installation at the National Tube Company, Christy Park Works, Pittsburgh, presents an interesting contrast in pressures. The turbine is driven by exhaust steam which enters at two pounds pressure, while the water leaves the pumps at 2000 pounds.

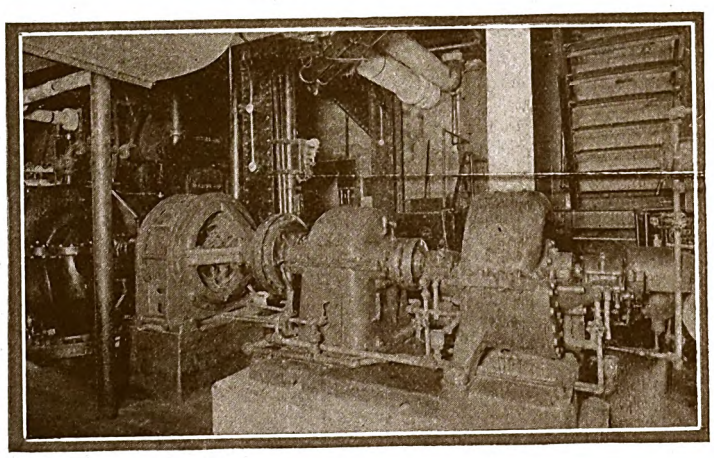


Small turbo-blower units for undergrate forced draft have come into wide general use. These units run at speeds varying from 2500 to 5000 r.p.m. and are throttle controlled.

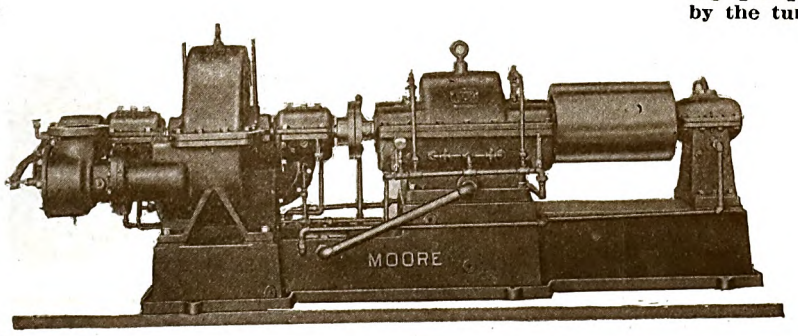
more efficiency from some steam auxiliary in his power plant, while at the same time blowing many times the amount of live steam thus saved into a process or plant heating system. In numerous cases, in fact, power is merely a by-product of the steam required for heating and costs practically nothing, aside from the investment in the prime mover.

A very clear statement of this often overlooked fact was made by Egbert Douglas in a recent article entitled "Facts About Coal Conservation," published in Industrial Management in November, 1922.

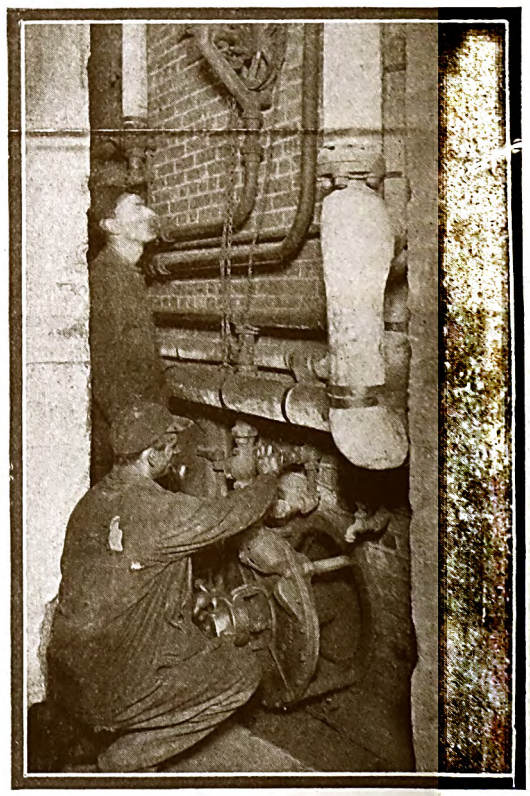
"In the metallurgical industries a large percentage of the fuel is used for melting metal



At the left another illustration of the modern tendency toward duplex drive for auxiliary units is reproduced from the plant of the Long Island Lighting Company at Northport, L. I. Here the circulating pump is optionally driven by the turbine or the induction motor.

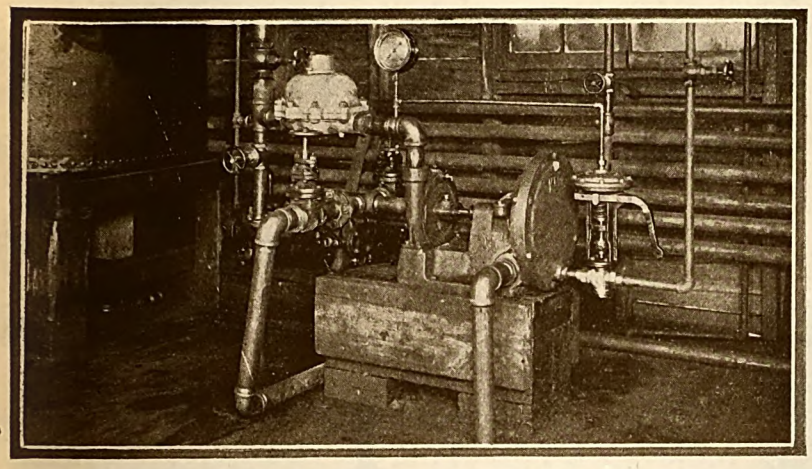


Small steam turbines, such as shown above, occupy very small floor space and are easily operated by common labor. For general conditions their efficiency is on a par with average reciprocating engines of equal power.



This shows the method of installation and operation of the turbo-blower for forced draft service. The propeller housing is inserted directly through the ash pit wall, and delivers air at pressure under the grates.

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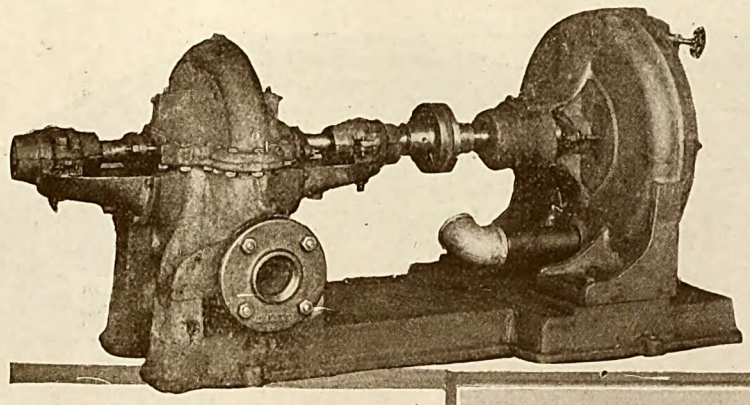
The field of the small turbine is rapidly expanding with knowledge of its useful qualities. For this reason the engineering thought and construction skill formerly applied to large units is now being applied also to turbines down to one horsepower in size. This unit shown is used for pumping gasolene into tank trucks.

and for other essential heat treating purposes. The amount of coal for such work is not influenced in the slightest degree by the amount of power used, or where such power is generated. In some of these factories the efficiencies of the melting furnaces are so low that the steam required for power purposes can be produced almost entirely by the recovery of waste heat from these furnaces. The malleable iron industries are striking examples of the possibilities in this direction. The melting furnaces in malleable iron plants waste more than eighty per cent of the total heat, which is passed off through the chimney, and these furnaces use the very best grades of our bituminous coal.

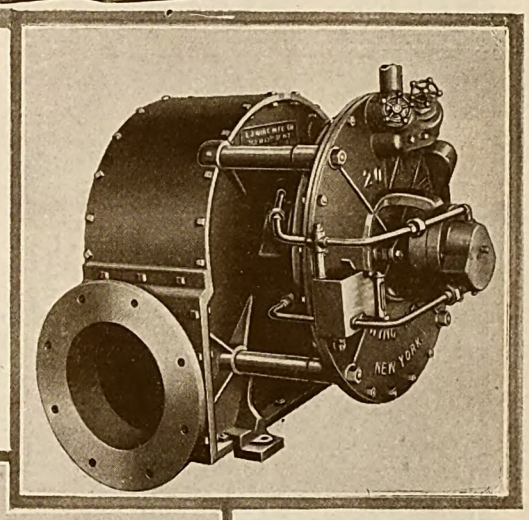
Large spaces have to be heated, not only the places in which the artisans toil, but in many industries enormous quantities of heat are required irrespective of the uses of power, or the number of people employed. Much of this heat is required continuously and is

(*Continued on page 68*)

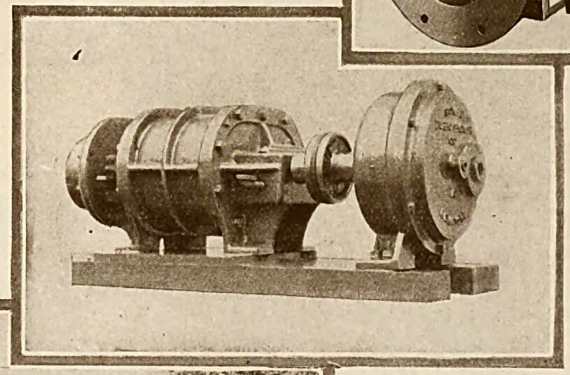
The 7½ hp. turbo-pump set shown finds many uses. Among them are circulating hot water, circulating oil, priming, and wherever liquid at the rate of 250 gallons per minute or less is required at not over 150 feet head.

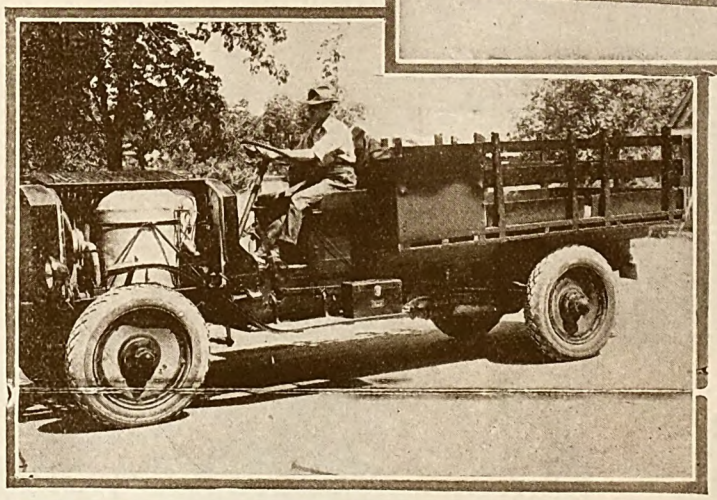


Small units, in blowers, pumps and generators are frequently directly connected to the turbine, or vice versa as in this picture. This adds to portability and does away with a sub-base.

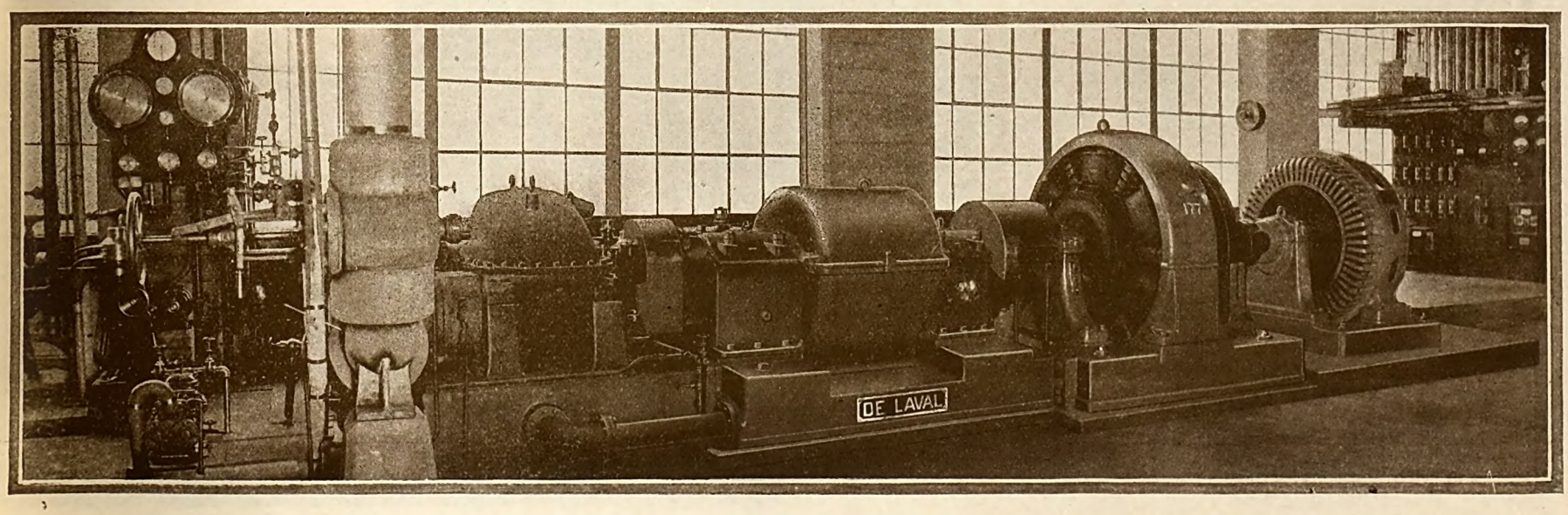


Turbines of fractional horsepower have many useful functions. The unit shown at the right is a positive pressure blower driven by a turbine of less than one horsepower.





The radiator cooling fan of this steam power motor truck is driven by a small steam turbine. This takes care of the pressure drop between exhaust and radiator and puts it to useful work.

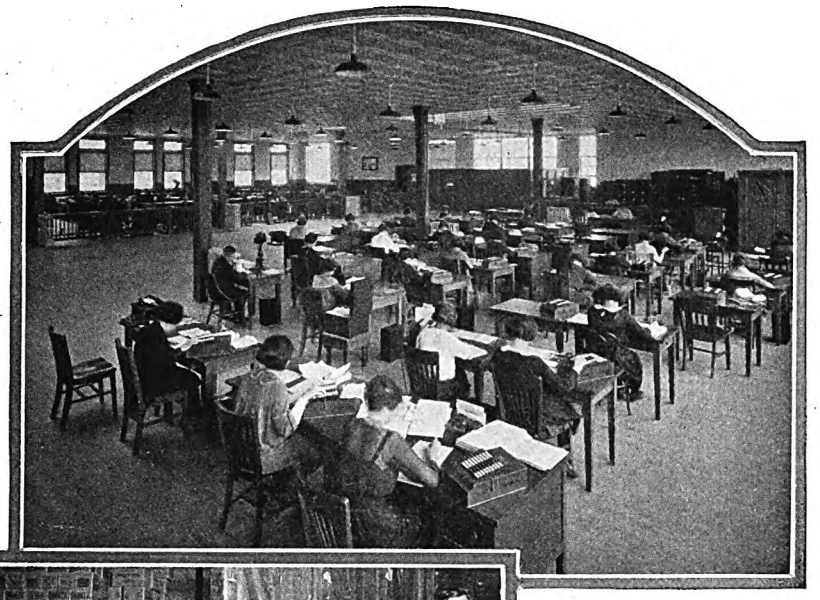


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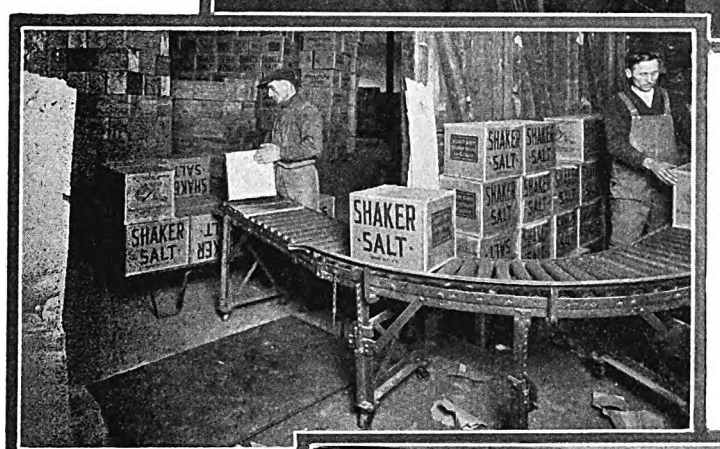
Food Distribution

The Economies of Large- and Modern

BY M. W.



View of the general office where orders are received and store accounts are rendered. Girls with adding machines do most of this work. Note room for expansion. Beyond the railing is the buyers' and manager's office.



Goods are received in car load lots direct on the plant sidings. To save time and expense material handling equipment is used wherever possible. The use of this gravity conveyor in unloading cars makes it possible for two men to unload a car in half the time required before it was installed.



Delays to trucks are impossible in this modern plant. The trucks delivering goods from outside firms are allotted space at the loading platform. The use of skid platforms and electric lift trucks keeps this space clear at all times.



In this warehouse with high ceilings it was found necessary to utilize overhead space. By the use of a tiering truck, and placing one loaded skid on top of the other as shown, the work was done quicker and with a money savings of over $100 per week.



Quick inventory is an essential. This shows the stock record room where a perpetual inventory is kept. The sorting tables contain a card for every item in stock and code cards are so arranged that ordering of low stocks is taken care of automatically.

In this room adjoining the one shown just above the inventory cards are printed, punched, tabulated and sorted. The machine at the left will take a bunch of mixed cards and sort them at the rate of better than 60 a minute.



THE accompanying illustrations present a graphic story of the ordering, inventorying, receiving, storing, distributing, and delivering of groceries and meats in a large modern food distributing plant—that of the H. C. Bohack Company of Brooklyn, N. Y. The entire plant covers 8½ acres of ground and has 235,000 square feet of floor space under cover. The three railroad sidings have a capacity of 43 cars and it is possible to unload at least 15 cars under cover. There is a building which contains the main offices of the company; a large garage and repair shop; a meat storage building with its own refrigerating plant; a coffee department with a daily roasting and packing capacity of 34,000 pounds; as well as the warehouse, where the goods are stored.

This company operates over 200 grocery stores and 100 meat markets on Long Island alone. All these stores are supplied from the distributing plant at least twice a week and some of the closer stores and larger stores are supplied every day. This calls for quick distribution and a smooth running system. The amount of business done in all the stores last year amounted to over $15.000,000 and this year it will be even more. These figures will give an idea of the

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as an Industry

Scale, Planned Distribution Handling Methods

POTTS

volume of goods handled daily by this plant.

When the orders are written by the store managers they must place them on order blanks furnished by the warehouse or main office. These order blanks are so arranged that the order reads in sequence with the way the materials are stored in the warehouse. This eliminates a considerable amount of walking on the part of the order picker, who takes the goods from the storage skids in the warehouse and places them on trailers. It has been found that by having a certain location for each item, it has increased the number of pieces handled by each picker by 50%, and eliminated mistakes that had occurred in the old warehouse.

Unfortunately the H. C. Bohack Company does not have any records or photographs of the methods of operation in the old warehouse but they do know that their present methods are more efficient and that goods are handled quicker and cheaper than with the old warehouse and old methods.

In a few instances, more recent, methods have been installed and it is possible to point out direct saving effected by the use of material handling equipment. It is the practice of the company to

(*Continued on page 71*)



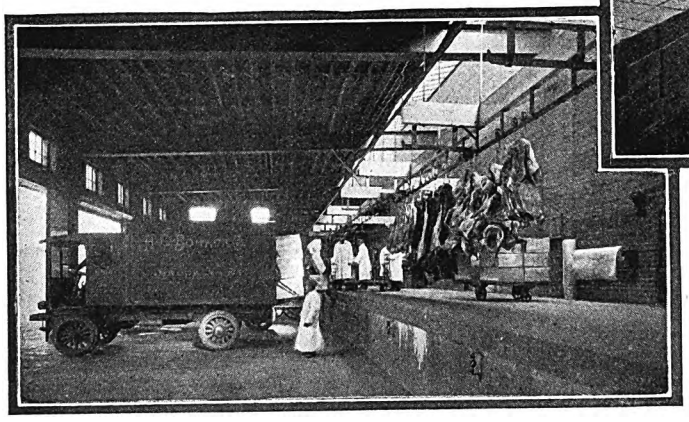
Wide aisles and a complete system of automatic material handling equipment makes it possible for the order pickers to handle over a thousand items in an 8 hour day. The tractor is taking a train of trailers out to the shipping bays and the lift platform truck is bringing a skid load of goods into the allotted space.



The equipment shown has been adopted as standard tractor trailer equipment. The trailers give no trouble in turning corners and require no trucks. Goods are only loaded on trailers when they are to be transported to the shipping bays.



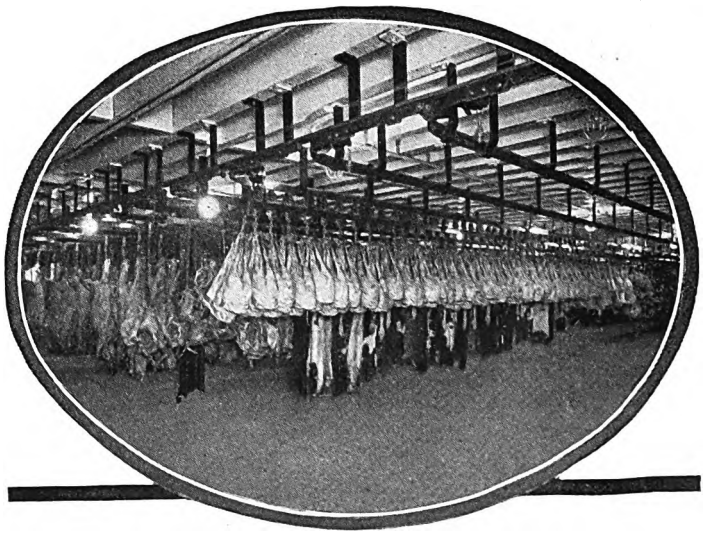
A general view of the shipping platform and method of loading trucks for store deliveries. When the goods are brought out of the warehouse they are placed in the forward bays until they are checked. Then they are moved, by hand, to the further bays where they are again checked before being loaded on the trucks. Frequent checking eliminates mistakes.



In the meat warehouse, all the most up-to-date handling methods are again employed. Boxed meats and small pieces are handled on plain and rack trucks. Sides of beef, calves and other large pieces are handled on overhead carriers. This is the shipping platform for the meat department.



Trucks standing idle eat into profits and delay deliveries. For these reasons the garage is supported by a well equipped repair shop.



This amount of meat is handled daily. The refrigeration for the meat stoarge is furnished from the company's own plant. The main point to notice is the amount of overhead carrier and the way the meat is suspended from individual carriers.

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A Novel Solution of the Dust Explosion Hazard

BY F. C. ALLEN, JR.

THE general public is little aware of the great dangers in many industries arising from the dust explosion hazard. That this hazard is real, however, is evident to anyone who will examine a statistical record of dust explosions.

Every year millions of dollars worth of property are destroyed and hundreds of lives are lost through the direct and indirect agency of dust explosions, which of late have been occurring with alarming frequency in a number of industries.

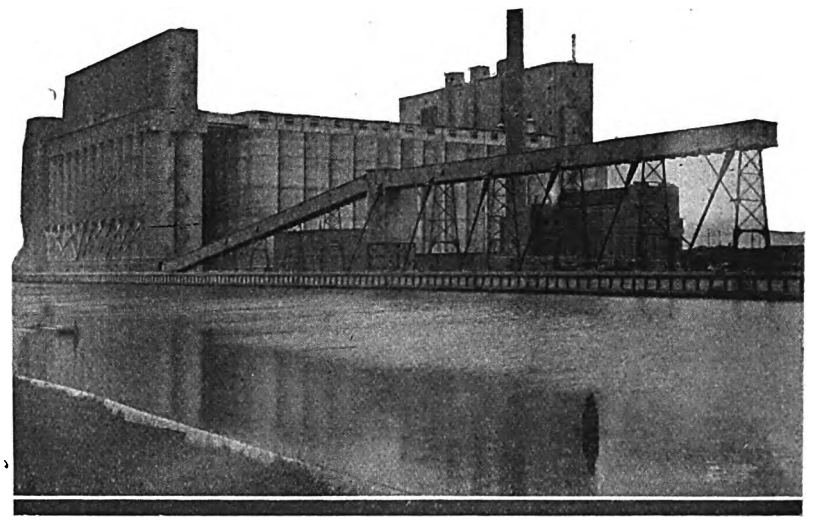
These industries wherein dust explosions occur are usually referred to as the "dusty industries." Among the many "dusty industries" may be especially mentioned grain elevators, coal pulverizing plants, mines, starch factories, aluminum plants, sugar refineries, spice and coffee grinding mills, and so on.

Without attempting to go at length into a general discussion of dust explosions, it may be said, in a word, that the question is one of such vital import to the nation that for some years past a special engineer in the Bureau of Chemistry, U. S. Department of Agriculture, has been assigned to intensive research work in connection with dust explosions in various industries. This engineer is Mr. D. J. Price, who has unquestionably accomplished a great deal, not only as regards the compilation of statistics but also in the direction of research work in determining the causes and recommending means of prevention.

Furthermore the National Fire Protection Association of Boston, Mass., appreciating the importance of this subject, last year organized a Dust Explosion Hazard Committee for the purpose of studying the problems involved and preparing a more or less standardized code of rules and regulations aimed at the elimination of this hazard. Mr. D. J. Price was made the Chairman of this Committee, which is now engaged in this important work.

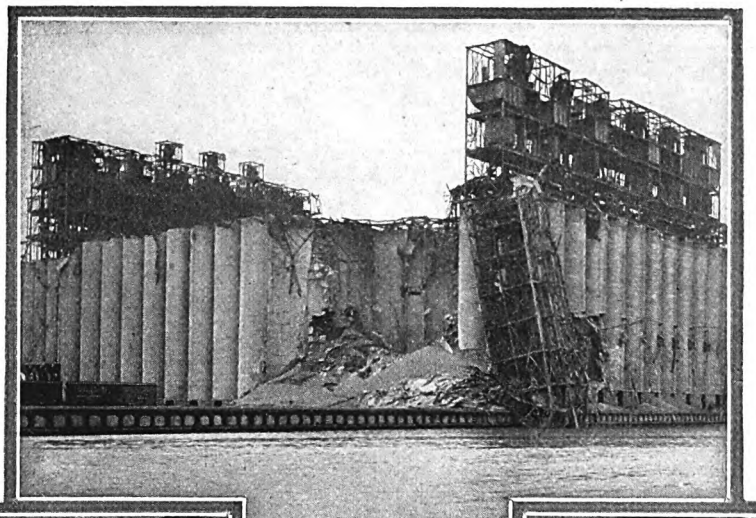
Experiments have shown that a dust explosion is very similar to a gas explosion and as in the case of gases, we find that different dusts are relatively more or less explosive and that different percentages or different "mixtures" of dust produce varying pressures, as in the case of varying gas mixtures.

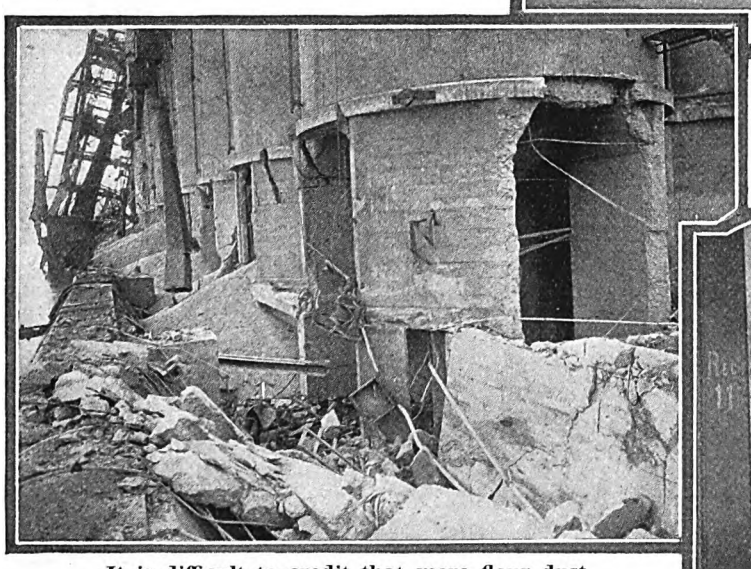
Some of the most disastrous



The Chicago and Northwestern Grain Elevator in South Chicago, as originally built; one of the largest and best built in the world.

Below—after the explosion of March 19, 1921; showing how completely the structure was demolished.





It is difficult to credit that mere flour dust could explode with such violence as this view testifies to.

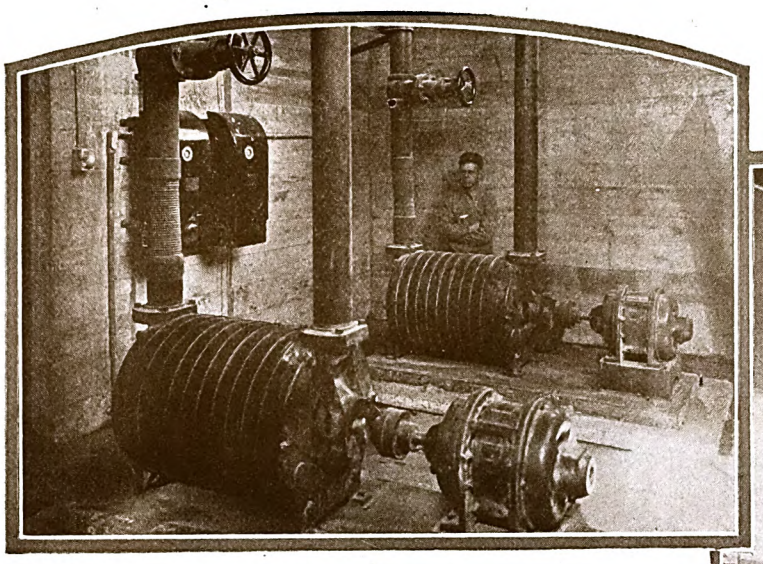


At the right—The method used in the rebuilt elevator, to prevent a repetition of the explosion.

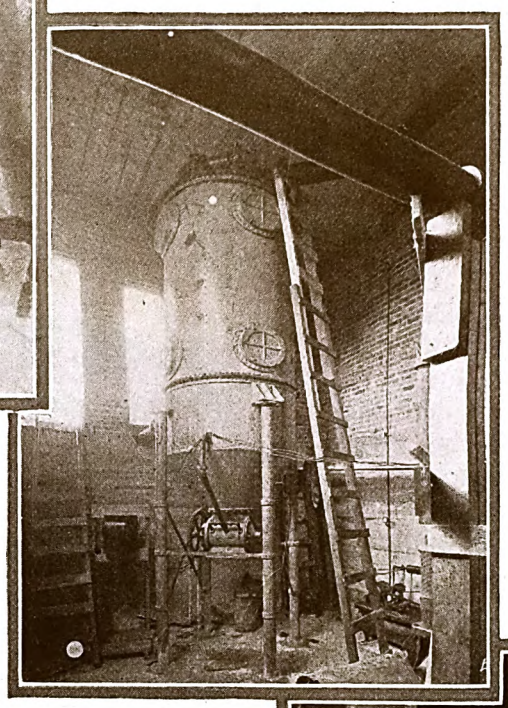


Small wonder that the concussion of this explosion of "ordinary dust" was felt more than fifty miles away.

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Two of the four large multi-stage centrifugal units which produce the vacuum for static dust removal. Each unit is driven by a 20 H. P. electric motor.



There are several of these large dust filter tanks, which discharge into a low pressure exhaust conveying system by means of ingenious valves that maintain the vacuum during the discharging process.

dust explosions have been in grain elevators, a typical example being the explosion which occurred in the Chicago & Northwestern Grain Elevator in South Chicago, about four o'clock in the afternoon on March 19, 1921. This particular elevator is the largest grain elevator in the world, having a capacity of ten million bushels of grain and one of the accompanying photographs shows this enormous structure as it stood in its massive majesty before the explosion occurred.

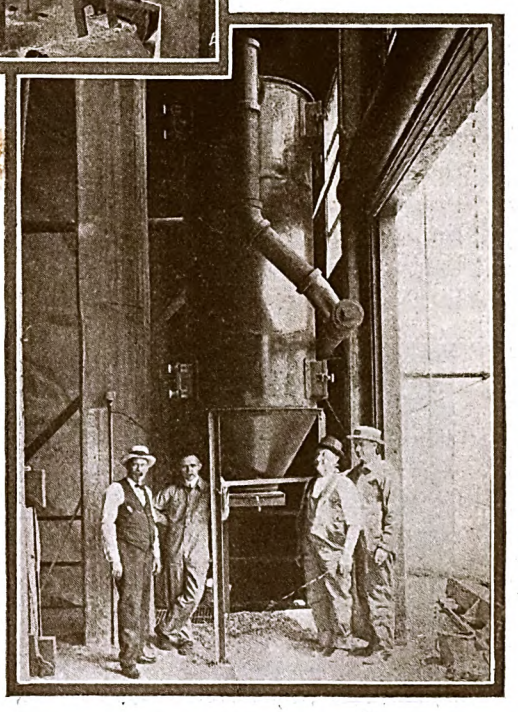
Had the elevator been filled with a charge of gun powder or dynamite the explosion could hardly have been more violent as it was plainly felt throughout the city of Chicago and as far away as Benton Harbor, which is more than fifty miles distant and located on the opposite shore of Lake Michigan.

From the standpoint of loss of life, it is significant to note that every man working in the plant was killed, either by direct impact of flying debris or by the tremendous force of the concussion itself. It was most fortunate that the explosion occurred late on a Saturday afternoon when practically the entire force of men had dispersed for the day, there being only six men left in the plant. All were killed.

Had the explosion occurred during the morning working hours, the loss of life would undoubtedly have been staggering.

The loss of property, including the damage to the elevator

(Continued on page 44)

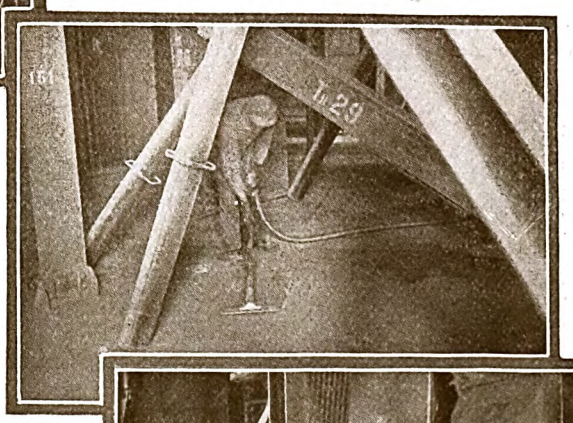


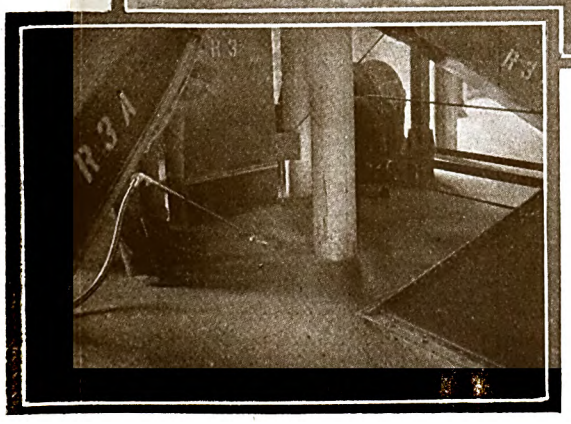
From two to three carloads of dust are collected at this elevator every day, being conveyed by low-pressure exhaust system to the dust house for disposal.





Large accumulations from accidental spills, are removed as shown above, instead of being shovelled; doing away with the dangerous dust-raising incidental to the old method.





The four views grouped at right and left show how the pneumatic system permits of rapid, easy—and, above all, dustless—removal of static dust in all parts of the building.



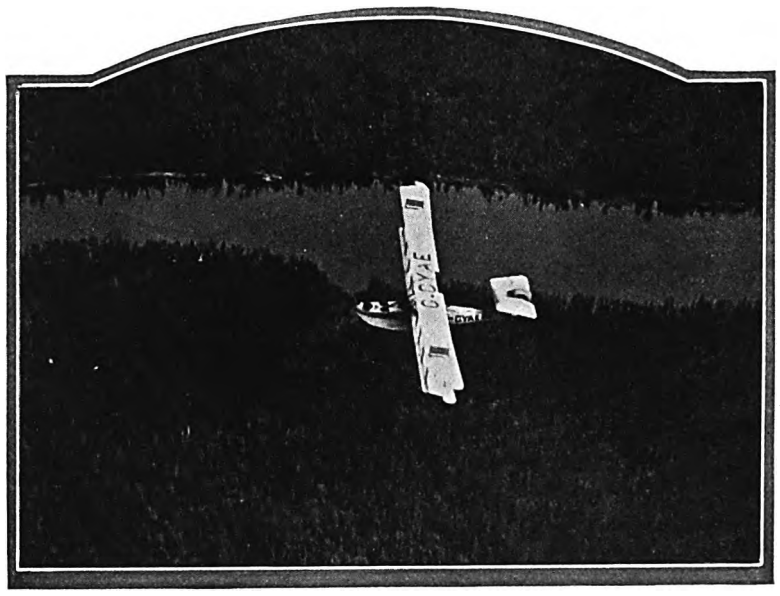
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Converting the Airplane to Peace-Time Use

What Canada Is Doing With Her Air Forces

BY D. M. LEBOURDAIS

IN olden days the beating of swords into plowshares was not a difficult matter; and it is quite conceivable that a piece of steel which had once done service as a sword would have made an excellent plow. But in these modern days of highly specialized killing the equipment of warfare is not so readily converted into instruments of peace. Heavy long-range guns, quite useful in devastating the face of a fair country-side in war-time, are now of no further utility than to stand as ill-chosen ornaments in our parks and public squares. The great, lumbering tank might perhaps be hitched to the plow, (fashioned shall we say, out of bayonets?) but even so it is doubtful if its work could not be done more quickly and much more efficiently and also less expensively by an ordinary farm tractor; so the tank must likewise be written off as a total loss, save, perhaps, for its value as junk. With the exception of a limited degree of utility in scientific work, such as oceanography, and perhaps polar exploration, the submarine can also be thrown upon the junk heap with the cannon and the tank.



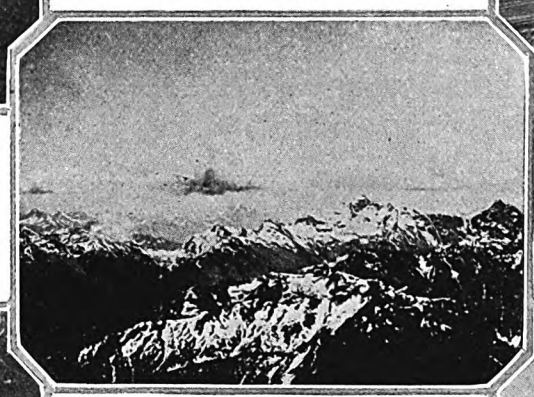
Cruising flying-boat, as seen from an aeroplane above. Studying and combating tree-destroying insects, is one of the new uses for which airplanes are adapted.

The aeroplane, including the flying boat, however, seems to be the one instrument which,

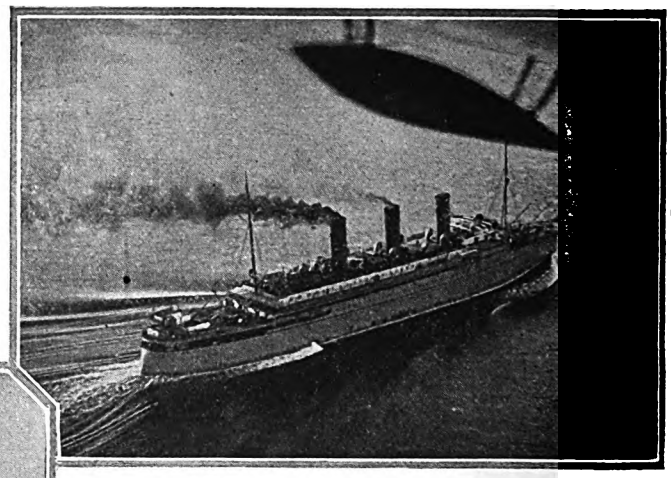
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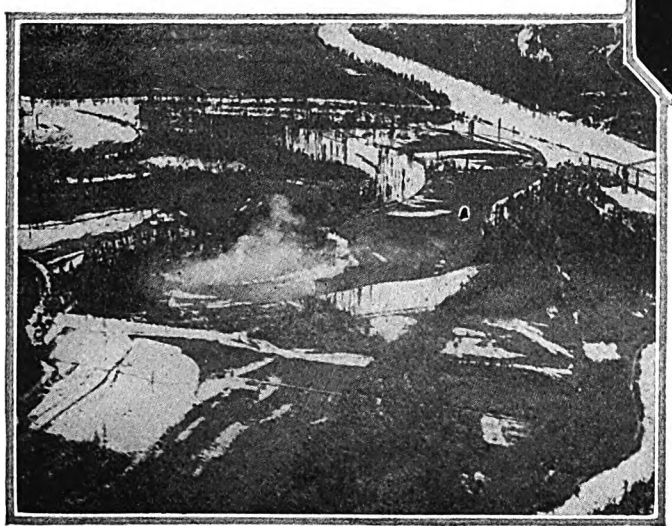
For surveys in connection with reclamation work there is no substitute for the aviator, when it comes to such districts as shown above.



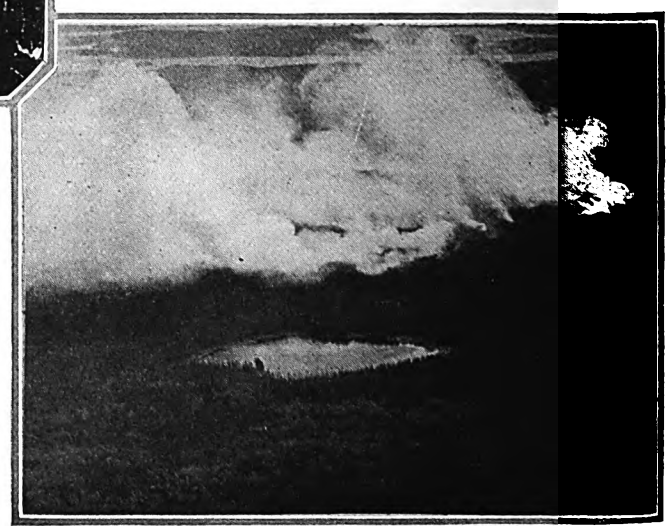
The Cascade Mountains, British Columbia, where seaplanes were used to locate primary triangulation stations for geodetic survey.



Above, the "Empress of Russia" is being convoyed by an air scout—not as a guard of honor, but to circumvent smugglers.



Fraser Valley, B. C. Here the man-bird was used to survey flooded areas for location of mosquito breeding places.



Not only can the aviator discover a forest fire, but he can reach it and summon aid in a fraction of the time required by rangers on earth.

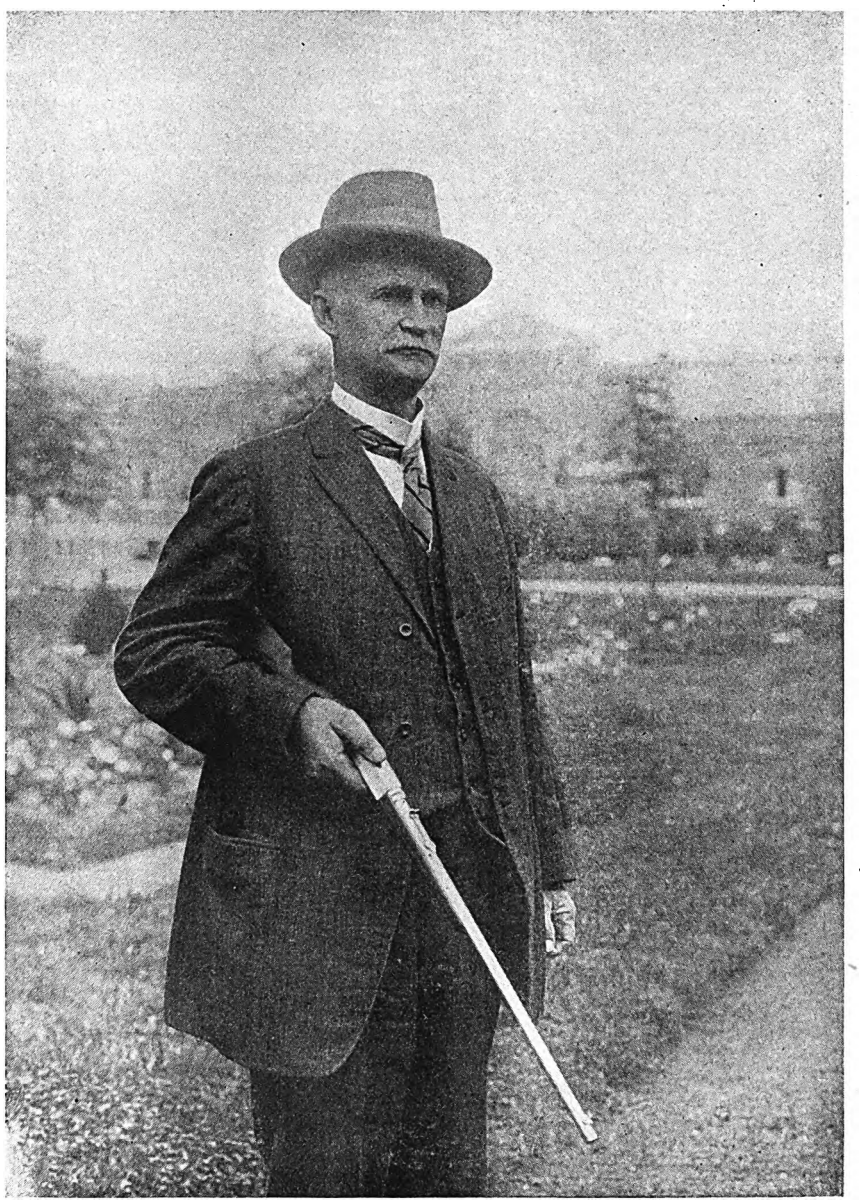
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The Man Who Converted a Bark into a Bite

The Career of John M. Browning, Inventor of the Machine Gun

BY ERNEST H. ROWE

WOULDN'T it seem queer, ye lovers of Wild West tales, to read: "With his insolent, twisted leer, Two-Gun Pete significantly tapped the holster of his Browning .45 ..." instead of his Colt .45? Or, "As those two flaming eyes confronted him, Jack brought the blue barrel of his Browning to his cheek and planted a rifle ball squarely between them," rather than his blue-barreled Winchester? Or, again, "As the great flock took wing we let fly at them with our Browning pump guns"? Or, still again, "our hero, with affected carelessness, slid his right hand into the pocket of his coat and felt the comforting support of having the desperado covered with his Browning automatic"? But those alterations would be true, nevertheless. Winchester, Colt, Remington, Stevens,—breech loader, repeating rifle, auto-loading shotgun, pump gun, automatic pistol, light machine rifle, heavy machine gun,—nearly all are the inventions of John Moses Browning. Indifferent to the fame of christening his brain-children with his own name, he leaves that distinction to the manufacturers. It was not until Uncle Sam commandeered his genius for war service and he responded with a world-beating trio of machine guns, invented to order, that we ever heard of a "Browning gun."



John M. Browning, who not only invented the three machine guns which played such an important part in the late war, and which bear his name; but who is also the inventor of most of the Winchester rifles, Remington auto-loading shot gun and auto-loading rifle, Stevens 12-gauge repeating shot gun, Colt automatic pistol and numerous other weapons of war and sport.

You are safe in calling John M. Browning an American, for every connotation of the word is exemplified in him. Ancestry and nativity?—he is of the eighth generation descended from that Captain John Browning who came over from England exactly three hundred years ago in the "Abigail" and settled in Virginia only two years after the Pilgrims landed on Plymouth Rock. Pioneering?—his father was born in Tennessee, he moved to Iowa, then in '52 he trekked again by ox-cart to Ogden, Utah, which had been settled the year before. There, on Main Street, John M. was born, January 23, 1855. Hardy rearing?—when your father is a blacksmith and gunsmith in a small frontier town, and you are the thirteenth of his twenty-two children, there's no lap of luxury about his leather apron to make you soft. Schooling?—the common school, the great outdoors, his mother's knee, his father's shop. Brains?—he probably never heard of ballistics until the gold braided professors of military science asked him to come East and tell how he made pistols and rifles do the things they talked about and charted on paper. He does not think in abstractions; his mind works directly with the concrete materials that make guns; his very brain cells, if you could get them under a microscope, must be arranged in firearm patterns. Ingenuity?—he made his first gun himself, when he was thirteen years old, out of scraps kicking around his father's shop. When he had an idea that there was energy to spare in the expanding gases when a gun was fired, which he might put to work, he found out by a device of his own. He placed a .45 against a board with a .45 hole in it directly opposite the bore of the gun. When he fired, taking the precaution to pull the trigger with a long string, the gun was kicked clear across the room by the pressure of the gas which followed the bullet and spread at the muzzle the instant the ball was clear.

Business sense?—an inventor who makes a million dollars a year hasn't let anybody exploit him. Character, square dealing?—the manufacturers who make his guns have become great, rich concerns with world-wide prestige; and there is not a man with whom John Browning has ever done business who would not welcome the chance to deal with him again, on the same terms. Love of his native land?—there isn't money enough in the world (and he has handled a pretty fair fraction of it) to make him anything but John M. Browning of Ogden, Utah, nor to get him away for very long except when, once in a while, some king sends for him to please come over long enough to get decorated. Democracy, unostentation?—whatever they do in Ogden nowadays which is the equivalent of sitting on the fence, chatting and whittling, you probably will find Browning doing any time he is not at work on a new gun. But for the fact that he and his ancestors have never lived anywhere but south of the Mason and Dixon line, you would say he looks like a Connecticut Yankee. The real Connecticut Yankees, of Bridgeport and

(*Continued on page 34*)

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Modern Factory Maint-

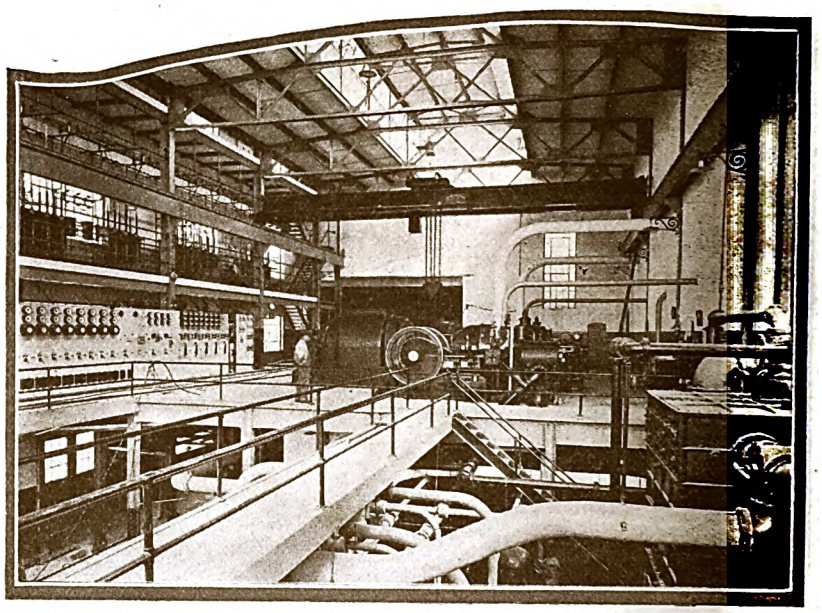
BY JOHN H.



This resilient, easily cleaned floor in the office of the American Pulley Company, Philadelphia, Pa., helps to expedite production as well as to convey the idea of neatness.

COMPARATIVELY few people know how closely factory floors are related to profits—or losses. Yet the relationship is simple and obvious when one thinks about it. Progressive factory managers have been thinking about it for a number of years which accounts perhaps for the remarkable development that has come about in the factory floors of today.

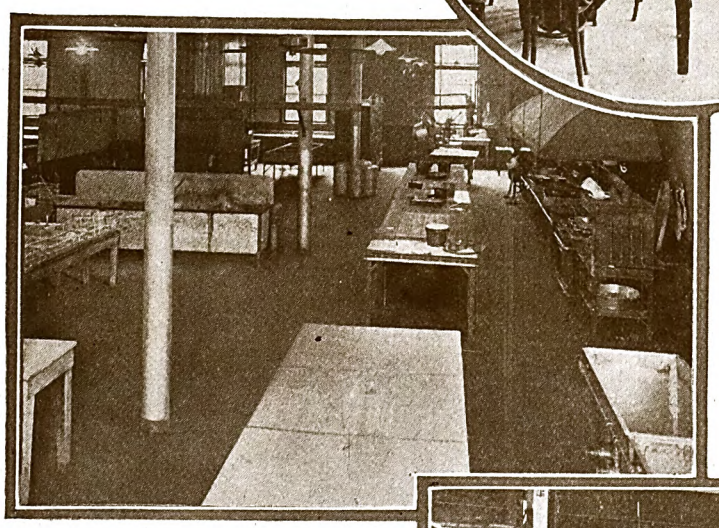
It wasn't so long ago, not more than fifteen or twenty years, that floors in factories were given but little thought. Perhaps this was due to the fact that "out of sight is out of mind" and most factory floors in those days were so cluttered and covered with all sorts of materials and parts that very little of the floors themselves were visible. Sometimes these floors were made of dirt, par-



Today the power plant and factory are considered as deserving of a good floor as is the office. Here is the power plant of the D. L. & W. R. R. at Nanticoke, Pa., with its non-abrasive and dustproof "Marbleloid" floor.

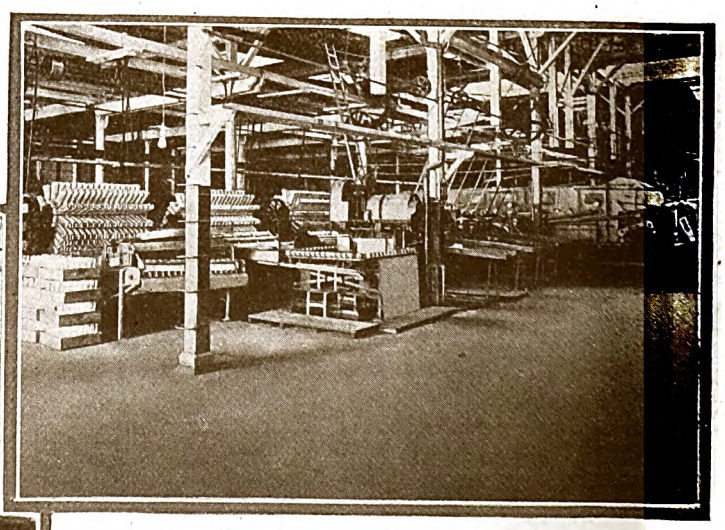
Ancient floors are not compatible with modern industry. So the cafeteria and the plant kitchen—both modern developments—have modern floors, easy to clean and to keep clean. At the right is the cafeteria of the Studebaker Corporation, at South Bend, and below the kitchen of the G-E restaurant at Schenectady.





The heavy pieces handled in a railroad shop provide severe service for floors on which they are piled, or sometimes dropped by careless workmen. Here is a corner in the Rutland, R. R. shop at Rutland, Vt., with its Johns-Manville "Industrial" flooring.





Whether the non-slipping qualities are as necessary now for brewery floors as before the Volstead era, is a question. Nevertheless, here is the bottling department of the Pabst Brewing Company, of Milwaukee, with a dustless, sanitary, non-slipping floor surface.

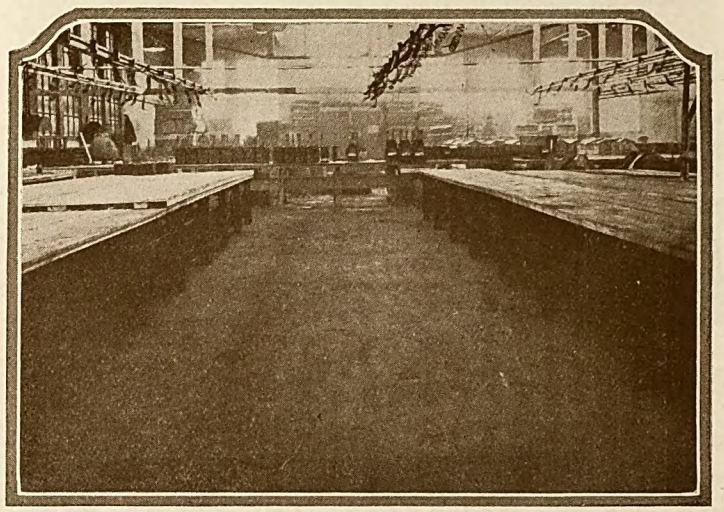
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Floors and Their enance

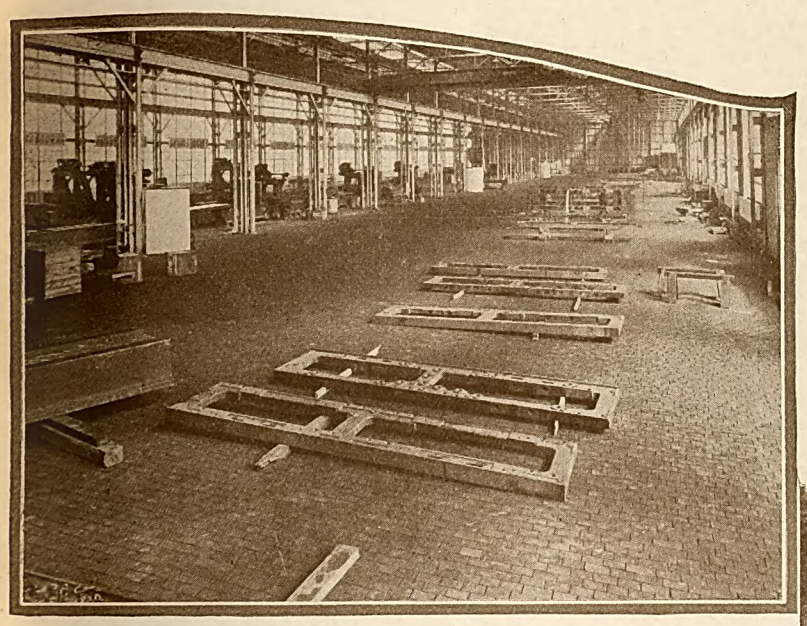
VAN DEVENTER

ticularly in foundries. Occasionally one encountered a concrete floor but this was a rarity. The old standby was the oak plank laid upon stringers with knot holes for the convenience of the numerous rats and mice that infested the average factory. Sometimes too, these knot holes were a convenience in the absence of telephone systems when you wanted to communicate with a person on the floor below.

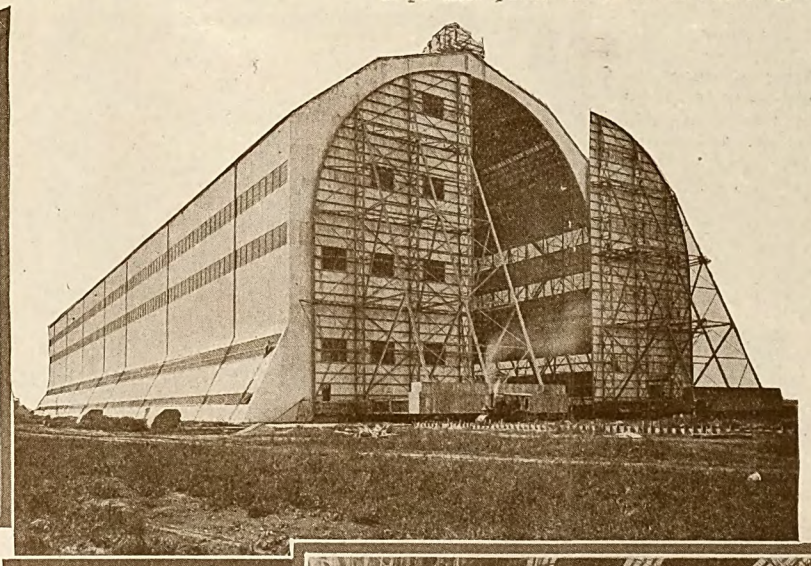
If you encounter a present day factory which has one of these old style floors that is cluttered up, dirty and full of knot holes and splits, you are safe in assuming that it is not making money very fast. For as said at the beginning of this article there is a definite relationship between factory floors and profits.



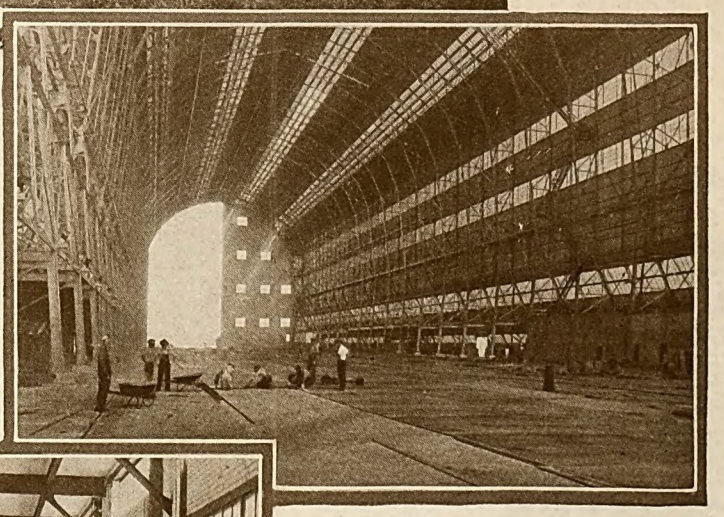
Corrosive action must be considered in choosing the floor in a chemical or acid using plant. Above is a battery assembling room in the Willard Storage Battery Company of Cleveland, which kept this point in mind in choosing its flooring.

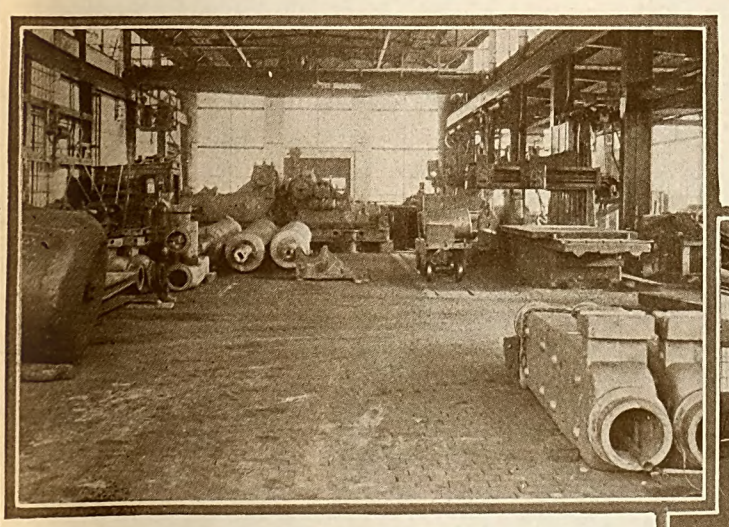


A "Kredom" wood block floor as installed at the plant of the Duplex Printing Press Company of Battle Creek, Mich. The blocks are set in hot pitch.



Laying the monolithic, mastic or asphaltum floor in America's biggest hangar, at Scott Field, Ill., the exterior of which is shown in the upper picture.





Here is a wood block floor which is subjected to severe loads of heavy castings, at the Fulton Foundry and Machine Company of Brooklyn, N. Y.



This new Union Pacific freight terminal, at Los Angeles, Calif., has a Vulcanite Mastic floor of 37,500 sq. ft. This floor is 1½ in. in thickness.

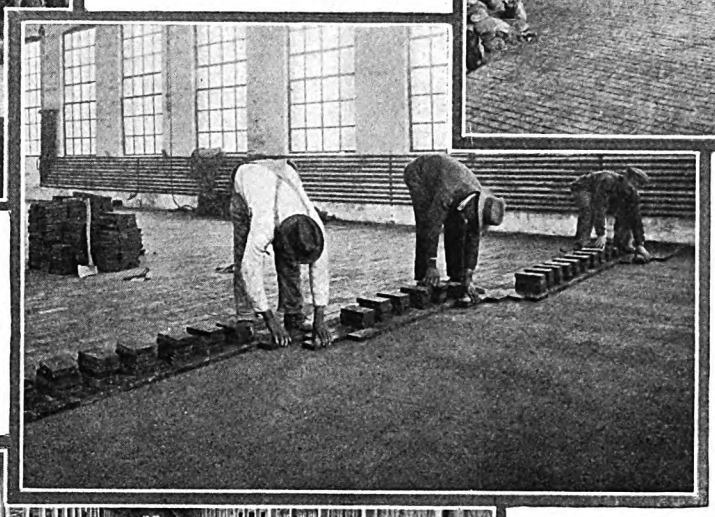
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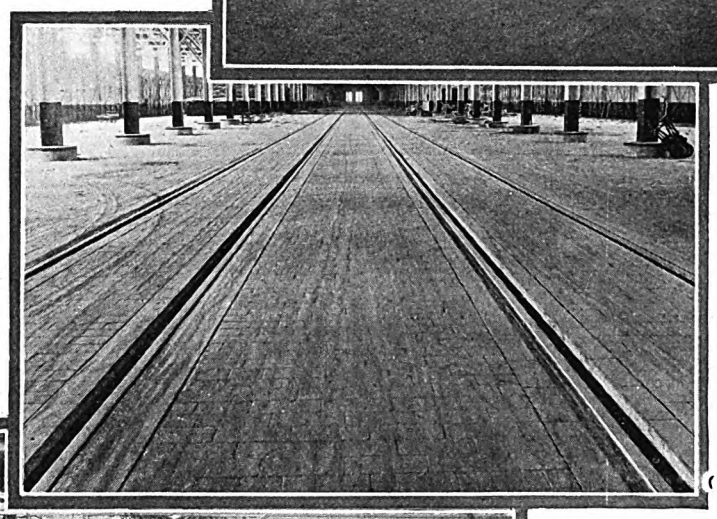
Getting ready to set wood blocks in a pitch binder, on concrete. Wood block floors are cool in summer, warm in winter and easy on the feet.

Asphalt block flooring, in its modern development, is admirably suited for factory floors. At the right is a view of the erecting shop of the Westinghouse Electric & Manufacturing Company at Essington, Pa., with its "Hastings" floor.

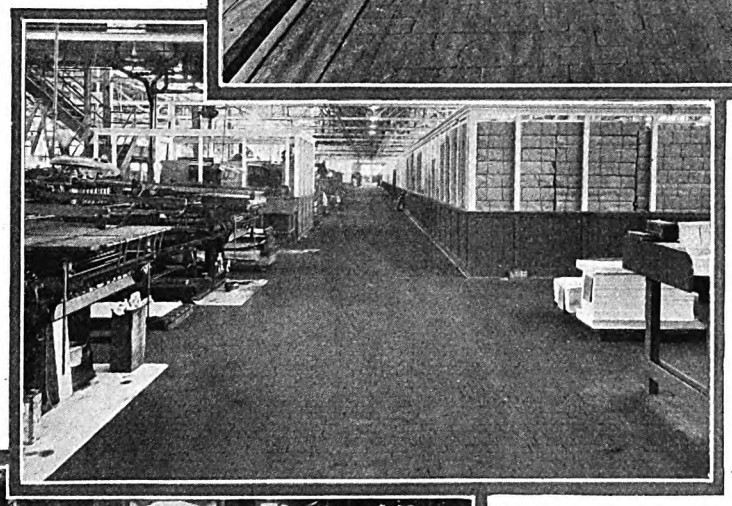




Asphalt blocks are ordinarily laid upon a half-inch mortar bed which is spread over the surface of the concrete base. The view at the left shows such a floor being laid in one of the American Cooper Products Company plants.



This is a portion of pier No. 4, U. S. Army Supply Base, Brooklyn, N. Y., paved in 1918, with 950,000 sq. ft. of asphalt blocks.



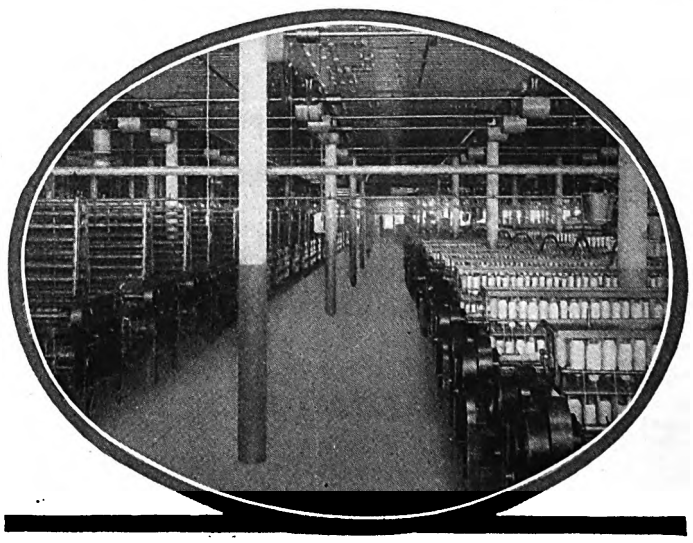
"Kreolite" wood blocks are used in this floor at the National Cash Register Company of Dayton, Ohio. The individual blocks are bound firmly together by means of a bituminous filler.



Wood block floors make excellent trucking surfaces, being resilient and quiet. Above is one of the stock room bays of the Westinghouse Air Brake Company of Wilmerding, Pa., floored with wooden blocks.

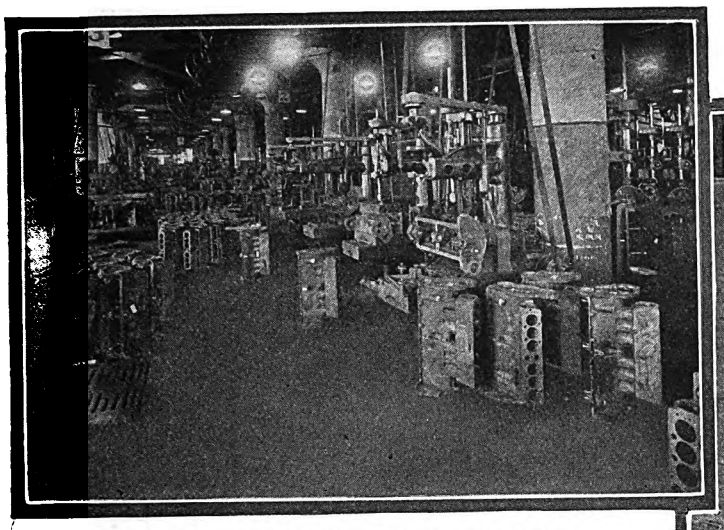
This relationship is summed up in the word *transportation.* The floor of a modern factory is not merely something to walk upon nor to pile parts or materials on, but is an integral part of the transportation system. The transportation system in turn is today a very definite and large part of the process of manufacture, determining its efficiency and hence the resulting profits. Thus the floor links up directly with the owner's or stockholder's pocketbook. Transportation, in other words, is the thing that has developed the modern factory floor.

Lift trucks, tractors and trailers have played a large part in this development. Not so long ago one can recall the days of the two-wheeled hand truck, whose chauffeur exerted his agility and ingenuity in dodging in and out of obstructive passage ways. In those days the stock room was most frequently found in the manufacturing department where piles of idle stock ate up floor space charges, and ac-

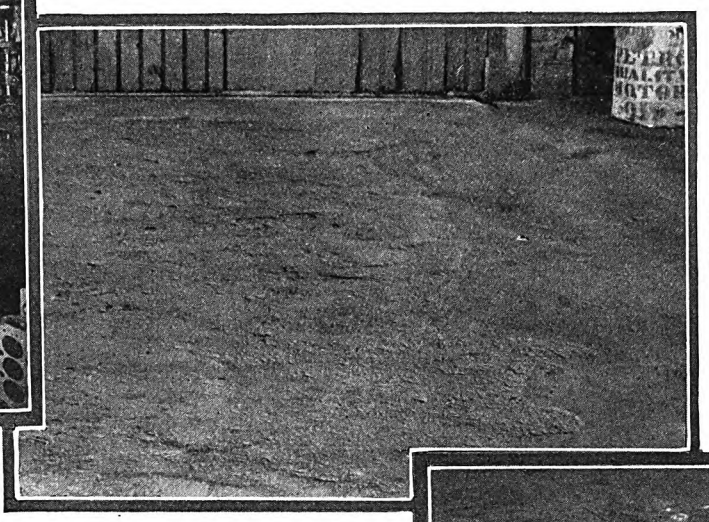


Underneath this hardwood floor and its base planking, in the Hoosac Cotton Mills, North Adams, Mass., is a "Tar-Rok" sub floor.

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Moisture-proof and air-proof sub floors not only protect the manufacturing department and its contents from dampness, but preserve the floor itself from mildew and dry rot.



Concrete floors are too well known to need illustration. But, as the Maintenance Engineer points out, they need proper maintenance. Witness (at left) this floor from which the topping has been worn off.

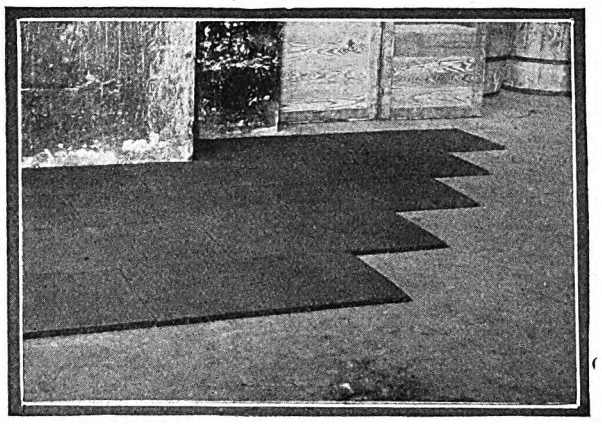


The rut in this floor is at a joint or seam in the concrete. When such joints are not well bonded, soft spots are likely to develop.

cumulated interest, to say nothing of getting in the way of so-called production. With the coming of the four-wheeled hand-drawn truck the question of factory "navigation" became more difficult. Hence foremen began to push material out of the passage ways and maintain more or less definite roads of traffic. Also heavier weights carried by these trucks exceeded the sustaining power of the crudely built wooden floors. Thus when concrete made its appearance it was welcomed as a means of preventing industrial train wrecks. Many are the crowbars that have been applied in lifting out the wheel of an old-time shop truck that had caved through an old-time wooden floor.

Concrete, of course, did a great thing for shop transportation in providing a continuous, hard and smooth surface over which it is easy to push or haul heavy trucks. Even today one finds many industrial floors of this material, and they cannot be excelled for durability and serviceability when properly hardened, mixed and surface-treated. Concrete gave a big impetus to transportation, and transportation to concrete, one alternately helping

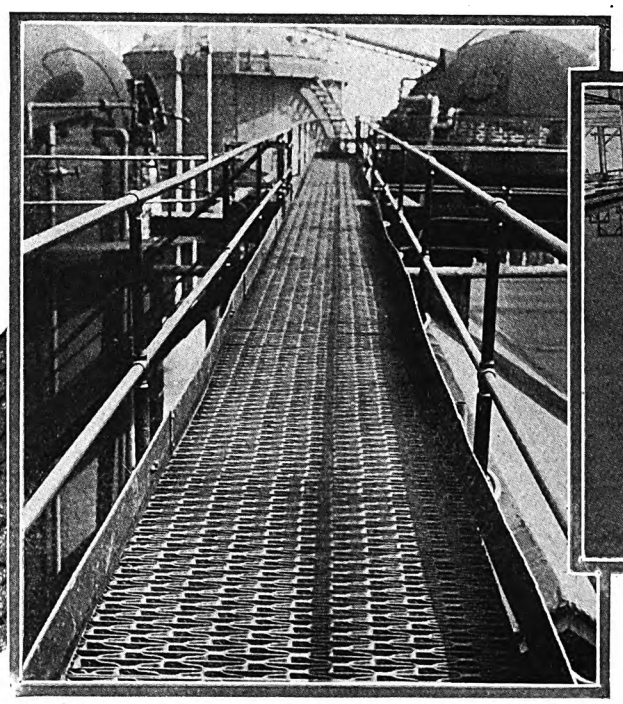
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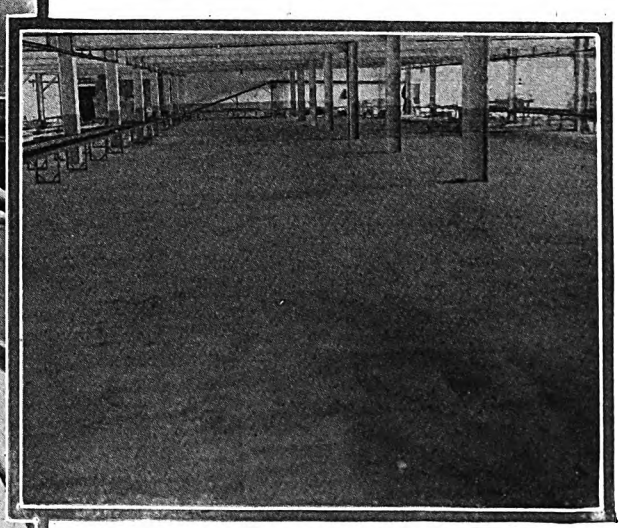
Fibre flooring, made as a by-product by the Endicott Johnson Corporation, in connection with their tanneries and shoe factories, is a recent development. It is really a leather floor.



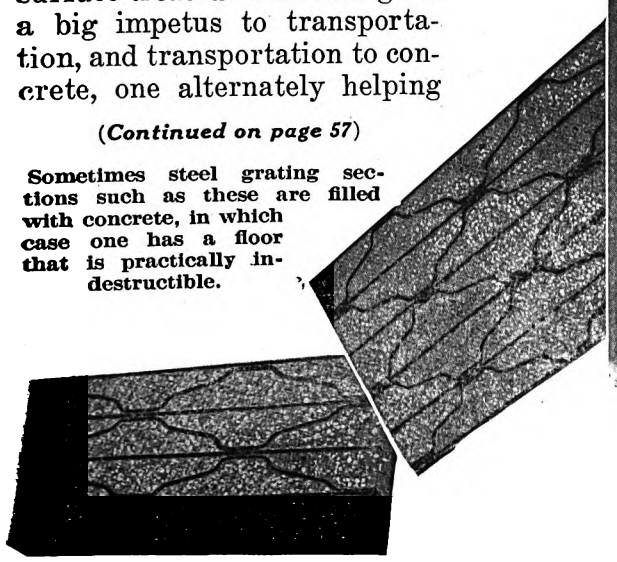
Here is a "scaled" concrete floor. When a floor has this appearance you can be pretty sure that it has been frozen. Proper mixing, surfacing and "hardening" will avoid such conditions.



Steel flooring has come to be recognized as filling an important factory need, both inside and outside the plant. Here, for example, is a "Kerlow" steel walkway in the plant of the Vacuum Oil Company of Olean, N. Y.



Here is an installation of a leather fibre floor. It is non-inflammable, a non-conductor of heat and "easy on the feet."



Sometimes steel grating sections such as these are filled with concrete, in which case one has a floor that is practically indestructible.

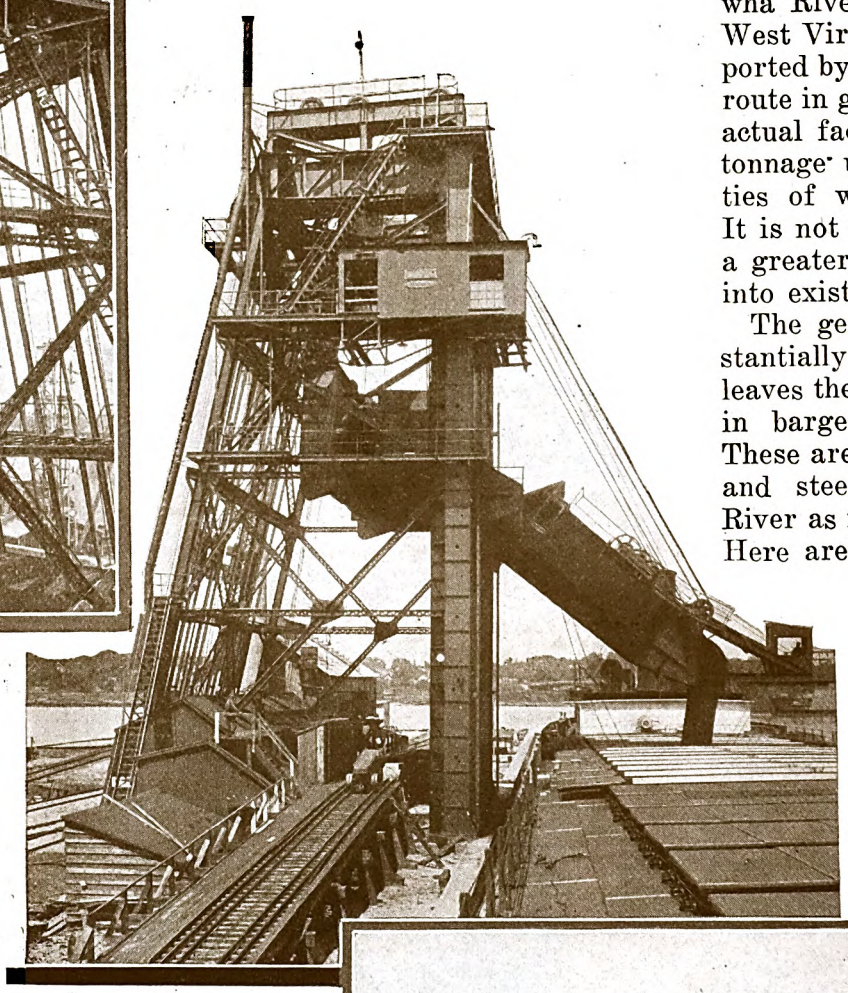
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Transporting Coal from Mine to Waterfront

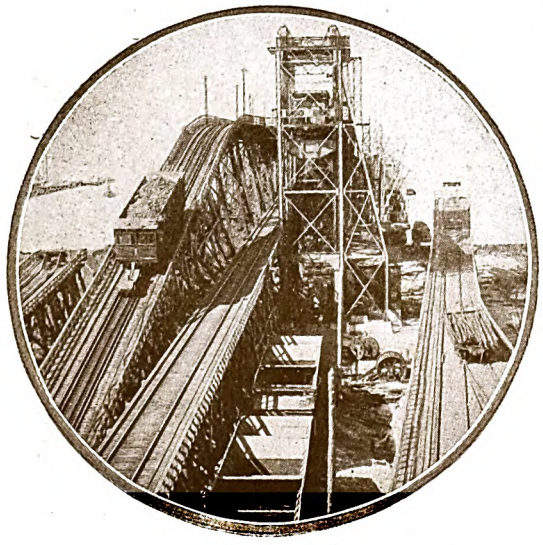
By J. F. Springer



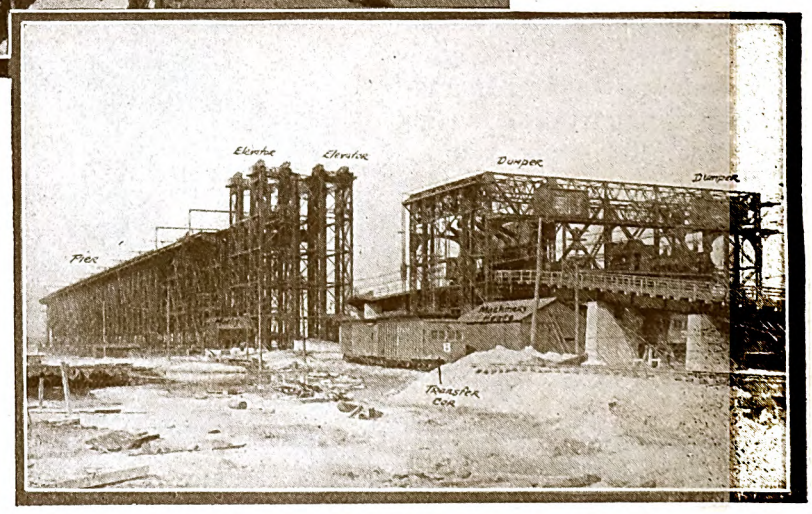
Side view of one of the great car dumpers. The pan or apron is here thrown up out of the way, the dumper not being in use at the time.



Big car dumper at Toledo, Ohio, dumping coal into a whale-back alongside. Hocking Valley R. R.



Upgoing track (on left) and return track (on right). Loaded car is being pushed up by barney.



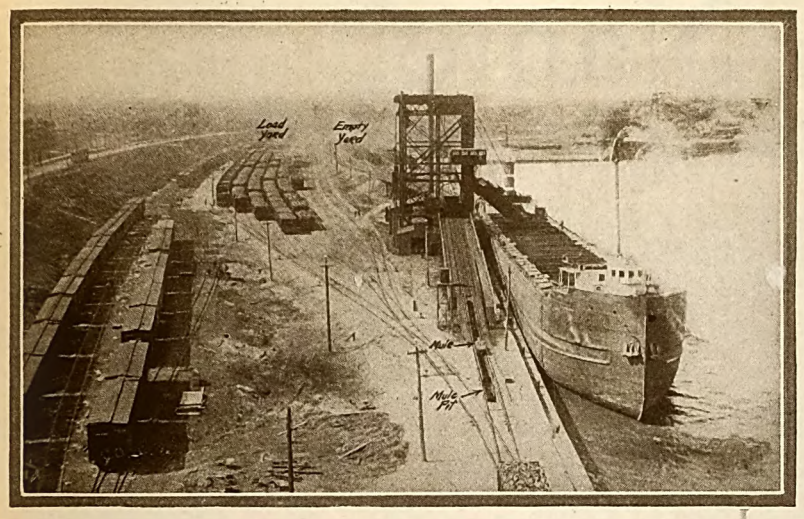
Great steel pier of N. & W. Ry., Hampton Roads, Va. Car dumpers on right. Elevators at land end of pier. Pier deck about 90 feet above water.

COAL mines are, as a rule, located more or less in the interior of the country. There are a few exceptions, as for example mines in the Cape Breton region. In fact, there is some coal mined underneath the sea in this section. But the exceptions to the general rule serve to emphasize that rule. In general, coal that is destined to reach the waterfront must be transported over a considerable land interval.

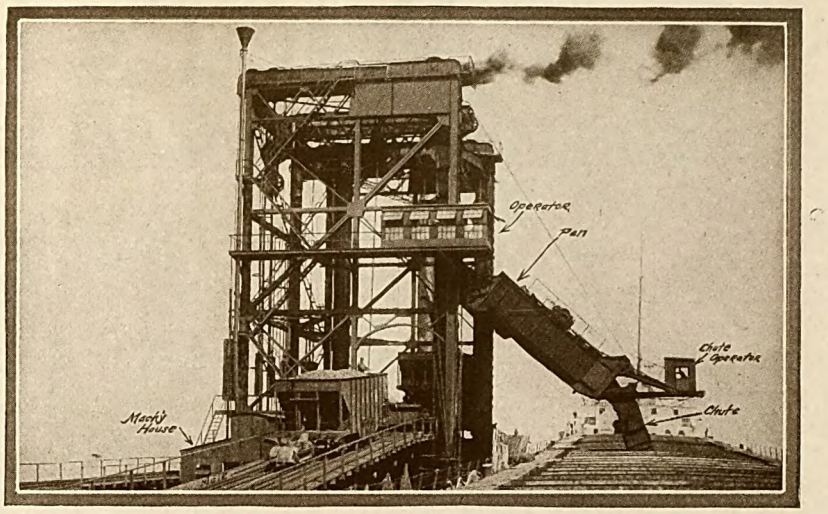
A fair proportion might be carried by interior water routes from the immediate vicinity of the mines to the seaboard, but this method is not in very important use in the United States. Coal mined along the Monongahela River in Pennsylvania and along the Kanawha River and tributaries in West Virginia could be transported by the Ohio-Mississippi route in great quantity. As an actual fact, only a moderate tonnage utilizes the possibilities of water transportation. It is not altogether clear why a greater traffic has not come into existence.

The general method is substantially as follows: The coal leaves the vicinity of the mines in barges of moderate size. These are assembled in groups and steered down the Ohio River as far as Louisville, Ky. Here are located the Falls of the Ohio. Either the group and the steamer managing it must pass these dangerous rapids at as favorable an opportunity as offers, or the group must be broken up and the barges

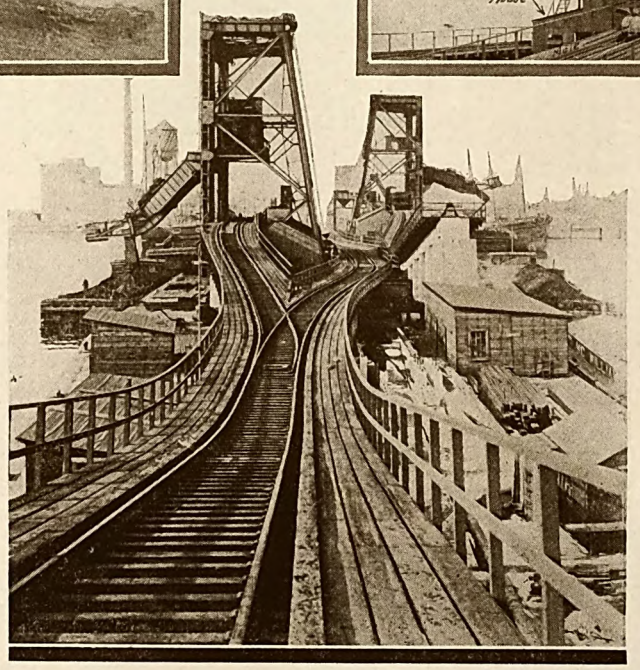
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Cincinnati, Hamilton & Dayton R. R., Toledo, O. Load yard and empty yard.



Pennsylvania R. R., Sandusky, O. This particular machine has unloaded at the rate of 45 cars per hour.



Central R. R. of N. J. Two car dumpers, Jersey City pier. On left, barge being loaded by the dumper near-by. Return track in foreground.

passed through the channel and locks of the Louisville Canal to the Ohio River beyond the Falls.

It is quite customary to regroup the barges into much larger aggregates than are used above the Falls. There may be as many as fifty-odd 1000-ton barges or boats in a single new group. A stern-wheel steamer is nosed in at the rear and the whole starts downstream. The current serves to do the real hauling. The steamer at the rear acts as a means of control. The destination may be the waterfront at New Orleans or at some intermediate city.

The barges may be sold for lumber at the southern destination, or they may come back empty. Or, if fortunate, they may bring a partial load of raw materials or manufactured articles.

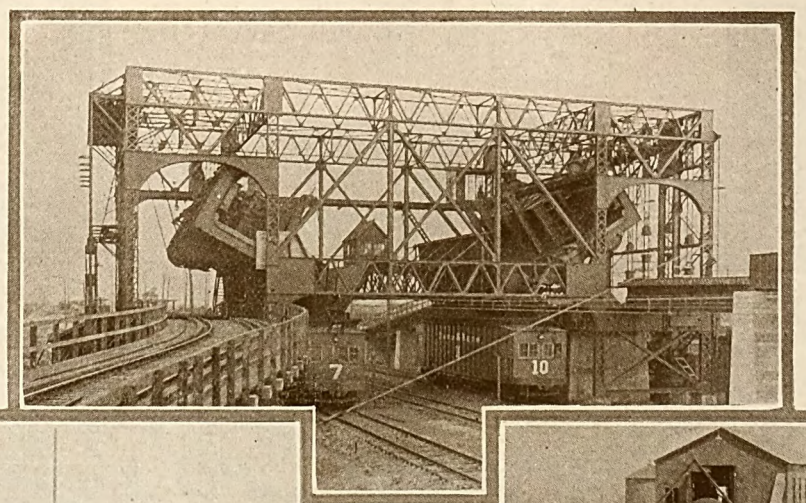
The foregoing will serve to cover that part of transportation from the mine that is accomplished by means of waterways. The Ohio-Mississippi route is the only important water route for coal in the United States. There is another that may ultimately become of importance. It seeks to deliver coal from the Warrior coal fields of northern Alabama at New Orleans. The rivers are used until the Gulf of Mexico is reached, when a short cut is made west to the Mississippi River or vicinity.

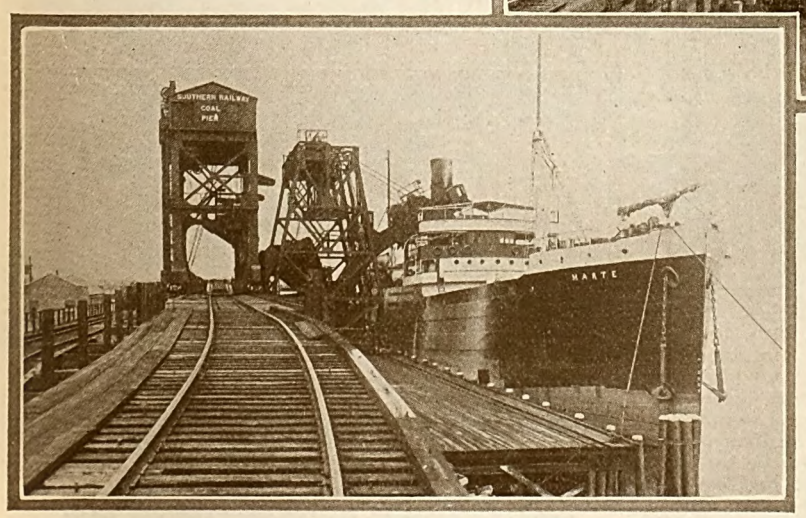
These examples of water transportation do not handle a considerable fraction of the total transported from the mine to the seaboard and other waterfronts. It is the railroad which carries the bulk of this traffic.

There are naturally various methods of getting coal from the mine's mouth to the railroad. Many, very many, American mines consist of workings that open on the side of a hill. The vertical hoist is absent. Examples of this type may be found in the Pittsburgh region. Then, there are mines which are altogether down underneath the surface and have no communication with the outside world except through vertical shafts. Then again, there are mines that do not correspond to one's expectations at all.

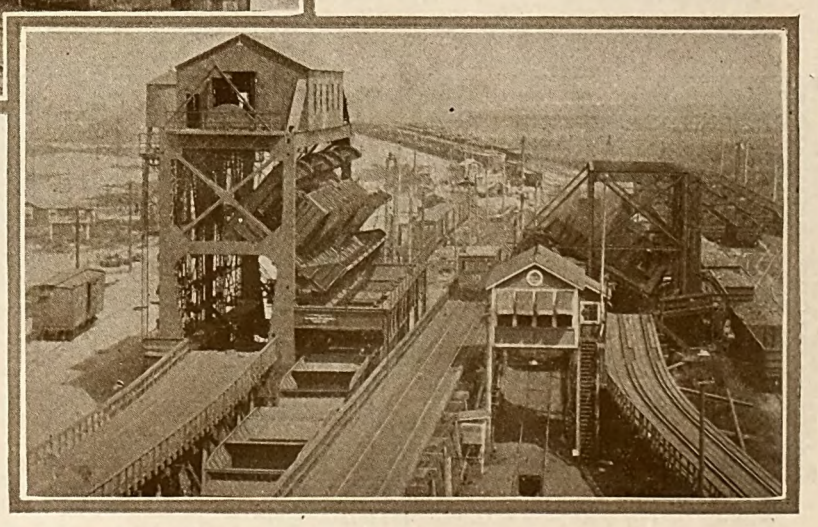
(*Continued on page 27*)

N. & W. Ry., Hampton Roads, Va. Twin car dumpers loading special pier cars preparatory to going out on pier 90 feet above water.





Southern Railway, Charleston, S. C. Car dumper on left. Delivers to loading machine to its right. Vessel still further to right.



Virginian Railway, Hampton Roads, Va. On left, cradle is overturned. Bars and wire ropes which retain car are visible.

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What's in a Name?

The Name Applied to Any Piece of Equipment Should Embody the Description of Its Use and Utility

BY MATTHEW WILLIAMS

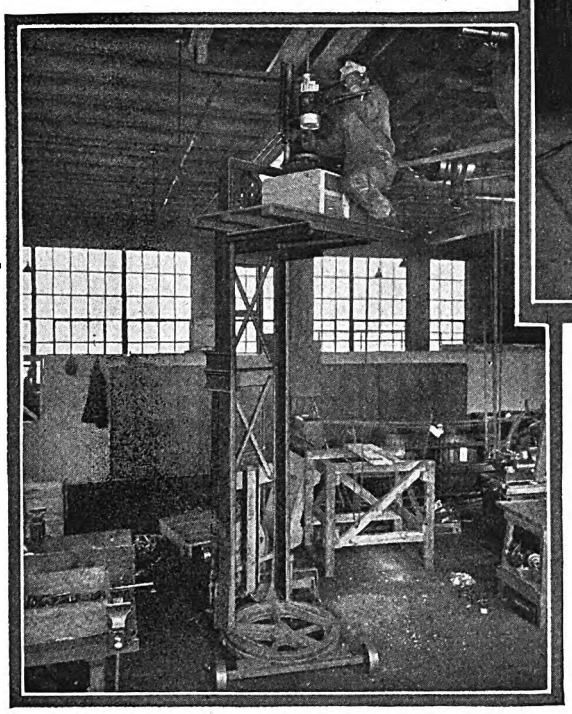
THE question, "What's in a name?" has always been considered more or less as a joke, but some jokes are expensive. There are several ways that a joke can be made expensive; first, by injury to a person and second, by injury to a business.

The material handling equipment industry is still in its infancy and therefore carries a lot of misnomers. Like calling a small baby "Sweetie" and then continuing to apply the same title after the baby becomes a grown man of large proportions, the title wouldn't fit; and the same is true about much of the material handling equipment.

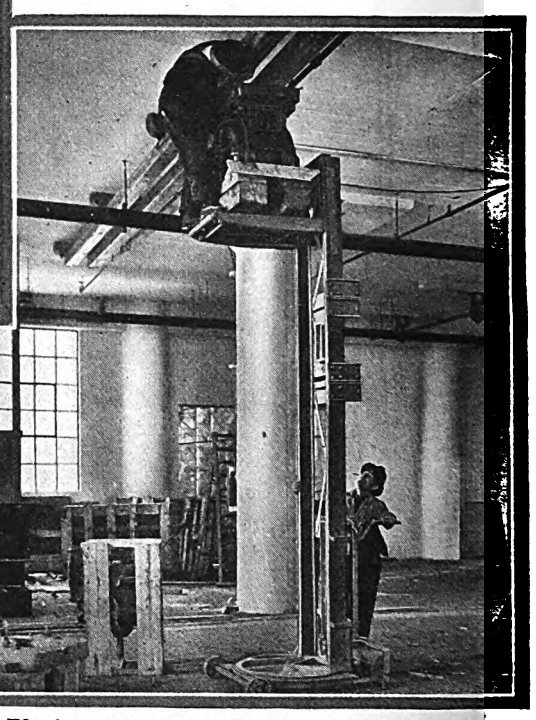
In order to get the attention of a prospect, the title should cover the broadest field of the equipment. For instance we will take the piece of material handling equipment commonly called, TIERING MACHINE and consider what this term implies. Tiering implies piling, and therefore we are led to believe that this machine can only be used for piling materials. This belief is



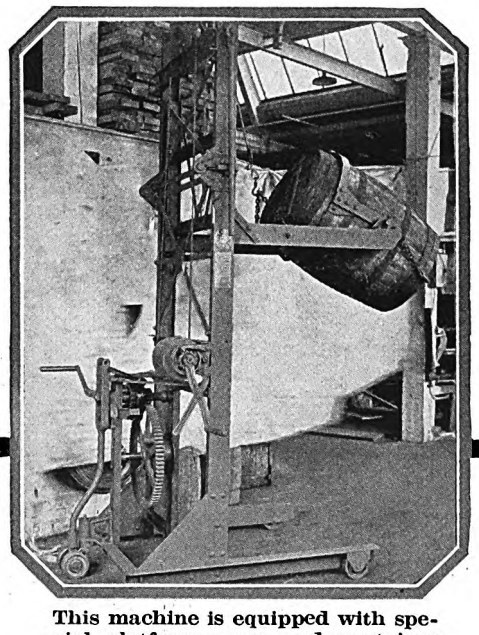
A Tiering machine being used as a tiering machine to pile rolls of wire. This is only one of the many operations that this type of equipment can be used on and that is why the name is really a misnomer.



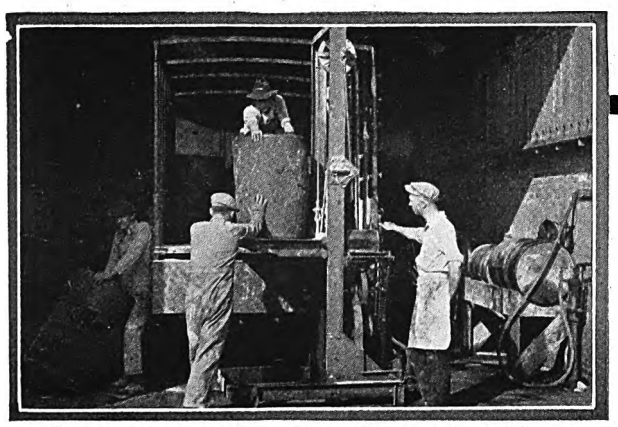
Another use for a standard tiering machine. Consider the advantages of hanging shafting with this method over the old method.



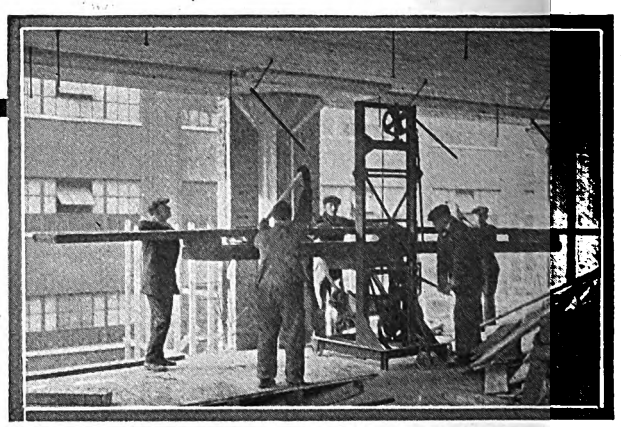
Placing motors overhead is a difficult job with the old rigging gang, but 2 men can easily accomplish this job in half the time after the motor is placed on the—?—platform. The section between the hinges is removable so that the same machine can operate under different ceiling heights.



This machine is equipped with special platform arms and container cradle. The dumping of the barrel or drum into a kettle or vat is accomplished by turning the crank of the small hand winch located at the side of the machine on the uprights. Chemical plants can use this attachment to advantage.

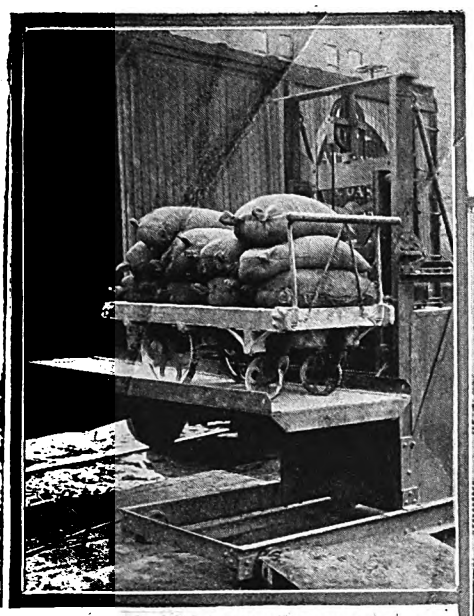


Increasing the field of the tiering machine by calling it a portable elevator caused this user to save money and time in loading trucks. (With a standard electric—?—)



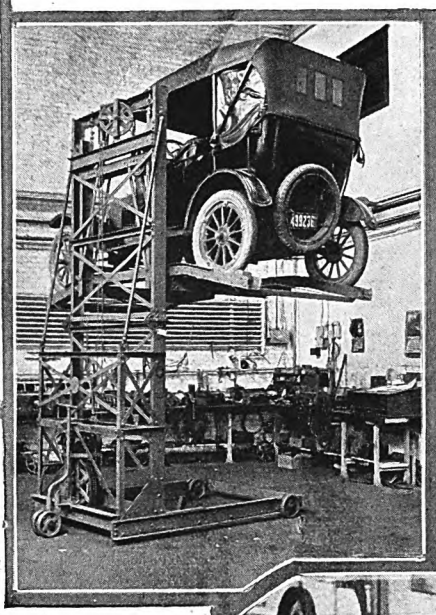
A standard tiering machine is adaptable in every line of work. This one has what is called an inverted platform, very useful in certain places.

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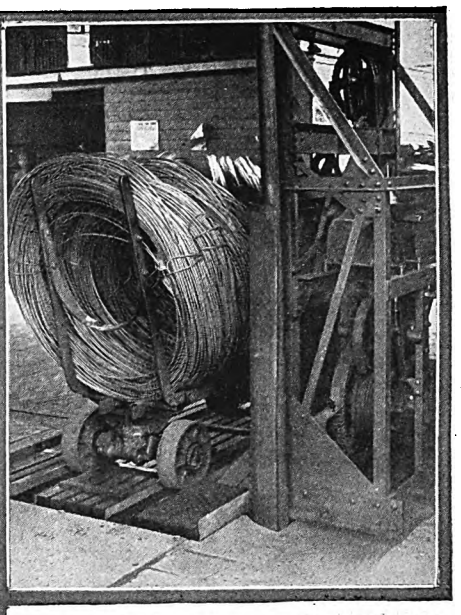
The United Materials Co. of Chicag saved the expense of building a car-loading platform by considering a standard tiering machine as a portable elevator and having it fitted with a special hinged platform, the overhanging portion of which works in and out of the car, automatically.

A special wide base machine built on the same design as a small standard machine is being used by the Hall Motor Company of Buffalo for elevating Ford cars so the mechanics can work under them.

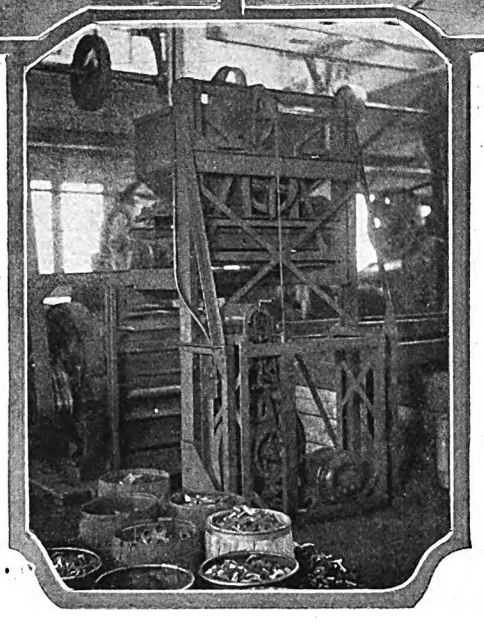




Machine built into an operatio i of the Interstate Iron & Steel Co. The machine platform lowers the truck of wire into a vat of water for the purpose of cooling and removing scale from the wire.



Companion picture. Formerly this wire was cooled by spreading the bundles on the floor of a large room and wetting them by means of the overhead sprinkler system, this required a large amount of space and made it difficult to handle the various bundles. It was also slow and expensive.



The installation of this machine in the plant of the Boss Nut Co. has increased the capacity of the tumbling barrels 75% and the work is done now by 1 man instead of 6.

brought forward by the manufacturers and this equipment has been so consistently advertised as a piling machine that a number of engineers have overlooked its adaptability to operations other than piling.

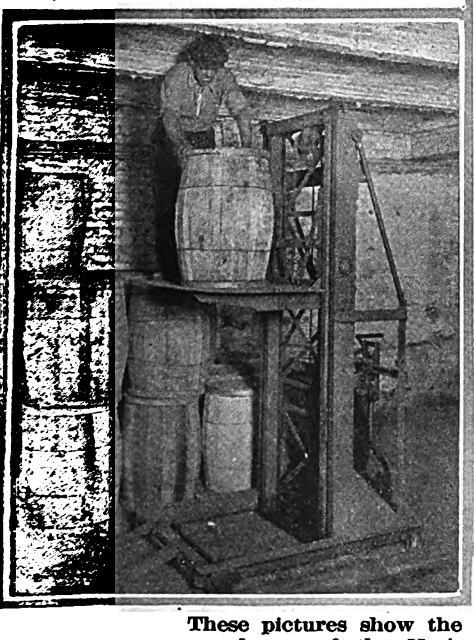
Referring to the Material Handling Cyclopedia, a book compiled by engineers, we find in the definition section the following: *"Tiering machine. A machine by which heavy packages are raised vertically to an elevation on a moving platform and then rolled or slid off on to the top of a pile or to an elevated rack; also called a portable elevator."*

Now the last part of this definition should be first, because then the prospect or user of this type of equipment would immediately get the broad scope of work that could be performed.

I firmly believe that the name "PORTABLE ELEVATOR" fits this equipment better than the name "TIERING MACHINE," and to show the readers why this is true we include photographs of the equipment piling materials and also operating on work far removed from piling.

Today every plant manager and plant engineer is trying to find new uses for existing

(*Continued on page 56*)



These pictures show the installation of a new model of —?— or—?— in the warehouse of the National Tile Co., New York, N. Y. This machine is a standard hand-power, telescoping upright and is the latest development in the design of this type of equipment. At the left the machine is operating with the uprights at their minimum height and on an operation of piling; the center view shows the machine at its minimum height but in a different position and ready to be used as a sidewalk elevator; the third view shows the machine with the uprights telescoped and the platform raised to the bed of the wagon for loading the barrel. The minimum height of this machine is 7′ 10″ and the maximum height is 12′ 11″.

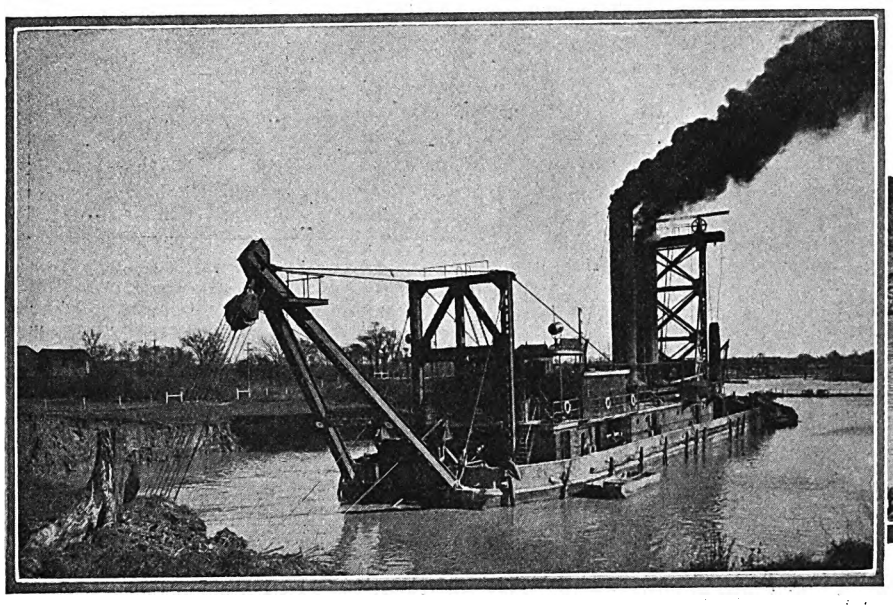


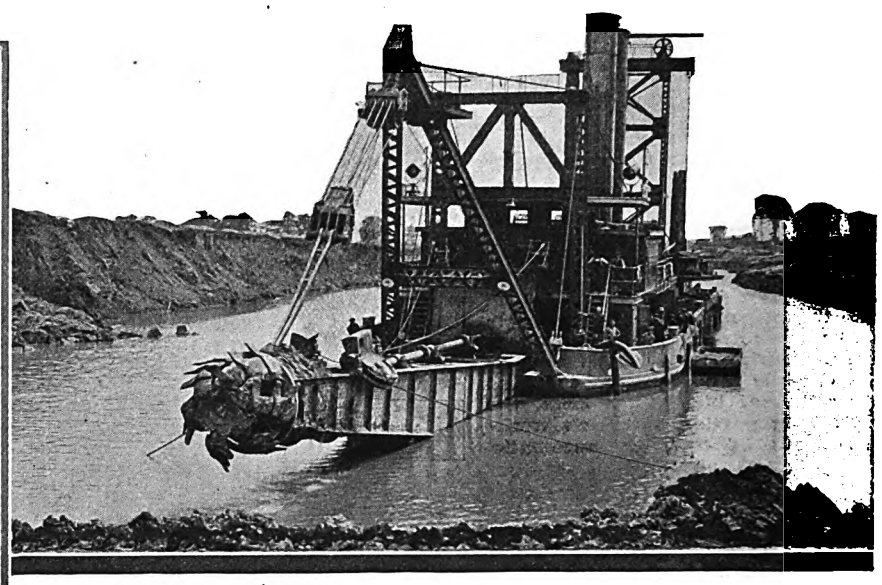
A telescoping hand-power machine used by the Museum of Natural History, New York, N. Y. This machine is 11′ 10″ minimum height, extending to 19′ 9″ maximum height and is used in the various rooms for all kinds of overhead work. The base is narrow, to go between cases, hence the outriggers.

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New Canadian Power Development at Niagara

By J. F. Springer





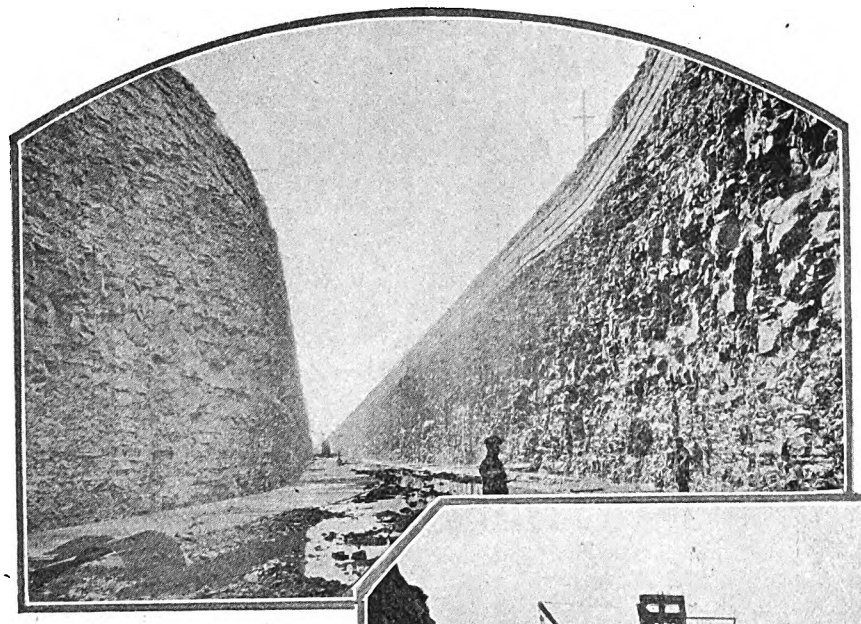
At right—Dredge working on Chippewa-Queenston hydro-electric enterprise. The cutting device is here shown above water.

Above—Same dredge with excavating device below water.

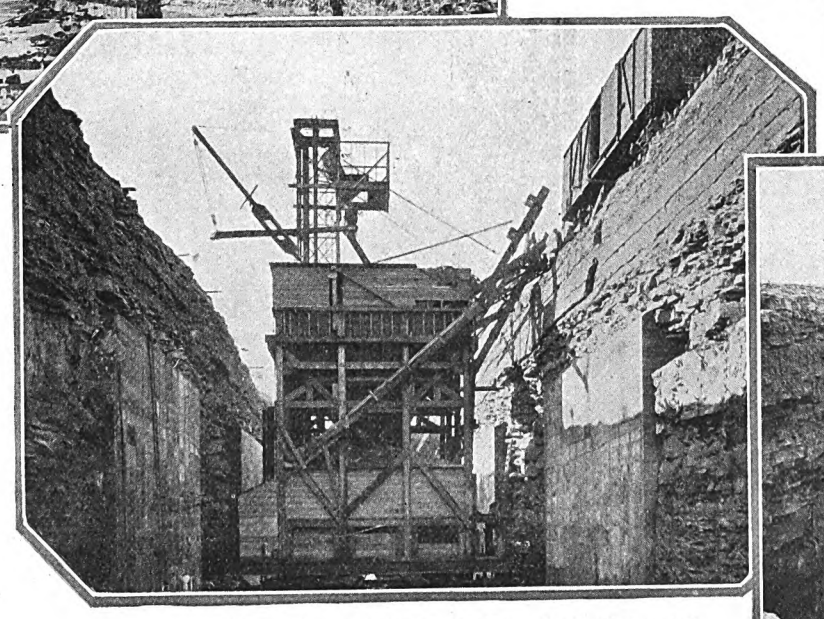
THE world has heard of a river diverted and the dry bed used as a means of entrance into a walled city; it has heard similarly of such diversion being utilized for the purpose of constructing engineering work; it has heard, too, of the voluntary disappearance of a river in the sands of a desert; and it has heard of a river being dammed and controlled for the purpose of converting its mechanical energy into electric current—but perhaps the first mention of a river reversed has been in connection with the great Canadian hydro-electric development at Niagara Falls. The Welland River flows from west to east in the region of country that lies between Lake Ontario on the north and Lake Erie on the south. Naturally at the end of the eastward flow, it empties into the Niagara River and its waters continue on north to tumble over the rocks at Niagara Falls. This Welland River is the stream which the engineers are reversing.

That is to say, the Canadians have, by an international agreement with the United States, the right to divert a certain amount of water naturally flowing over the Falls for the purpose of utilizing it in the generation of electric power. In accordance with this right, they are going ahead to withdraw water from

(*Continued on page 38*)

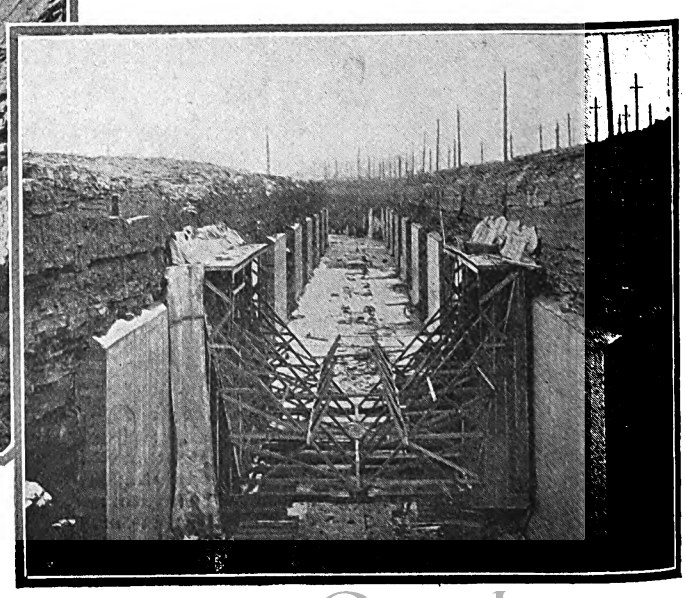


Deep cut in the 9-mile power canal connecting Welland River and fore-bay above power house at Queenston below Niagara Falls.



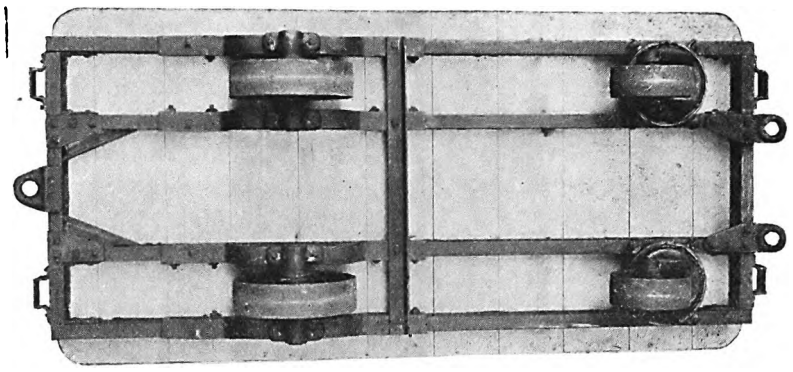
Concreting rig in cut for power canal.

Concreting vertical walls of shallow cut.



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Trailer Trucks for Shipping



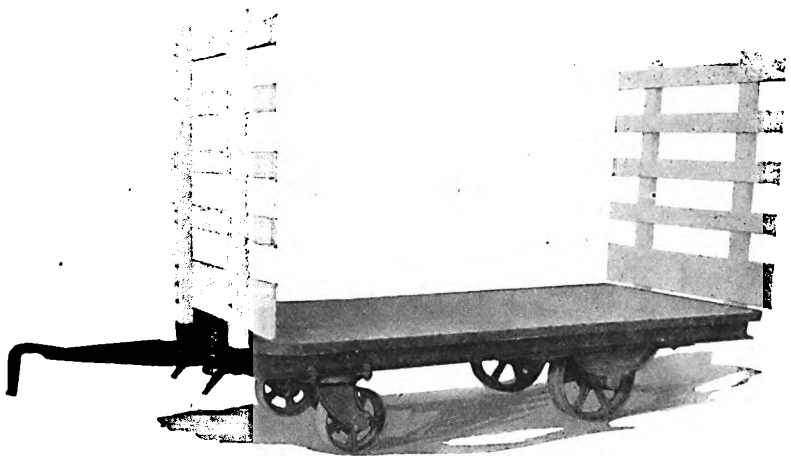
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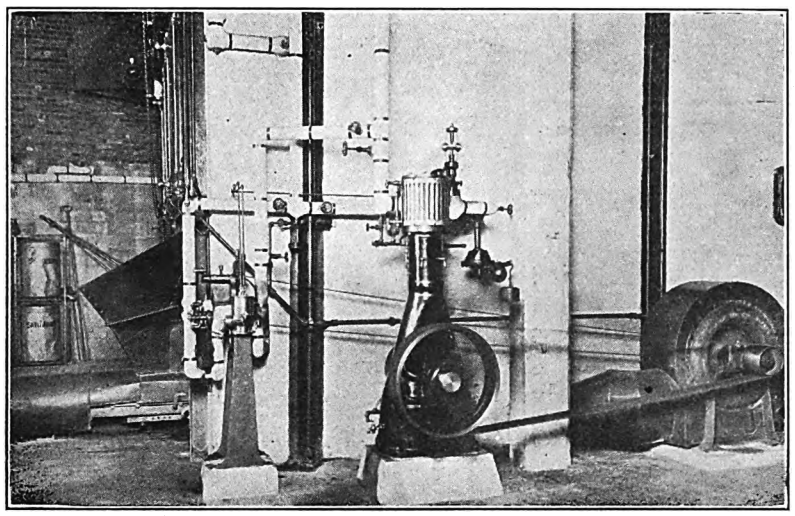
COLUMBUS, OHIO, U. S. A.

New York, 120 Broadway

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Write for the Troy Catalog

TROY ENGINE & MACHINE CO.,

TROY, PENNSYLVANIA

Transporting Coal from Mine to Waterfront

(*Continued from page 23*)

The coal is simply overlaid with a few feet of earth, so that the mining operations consist simply in taking off the cover and then getting out the coal.

What is often, if not generally, absent, particularly in the case of bituminous mines, is an adequate means of storage.

The coal goes into railroad cars at once. If there are no empty cars available, the mine shuts down until the railroad is able or willing to furnish them. This is ideal when everything works just right—when empty care are obtainable at the precise rate at which the mine should be worked. There is no extra handling. when coal goes into storage, there are two operations that will have to be taken into account. The coal must be delivered into storage, and later it must be reclaimed. Naturally, these operations cost money; and, while one of them may be regarded as more or less balanced by the fact that under the other conditions the coal must be delivered to the railroad cars anyway, there remains at least one operation. Not only must money be spent for extra handling but space must be found for storage and perhaps elaborate equipment. with which to do the handling.

But everything has to work just right if the coal mine is to operate without storage facilities. If there is a strike on the railroad; if other freight movements interfere with the regular operation of just so many coal cars, whether going away or coming back; or if the coal is not wanted at the destinations in stream of unvarying size winter and summer— if any of these things supervene, then trouble results and the mine shuts down in part or altogether.

What should be, are storage facilities at both terminals. Then the coal could be mined regularly throughout the year. Irregularities in transportation and consumption can be smoothed out in no other way. There should be no periods of threatened coal shortage. A certain amount of money would necessarily have to be spent to provide the storage yards and to operate them. And coal stored in them would mean a certain amount of capital tied up. All the same, there would be such perfection of mine operation possible and such perfection of supply, that the money benefit would probably far exceed the money disadvantage. Storage is the enemy of strikes and shut-downs, whether in the coal fields or in the consuming regions.

Coal once on the railroad car is theoretically coal on the way to the consumer. The car, however, is often a place of storage. It is not always, by any means that the loaded car proceeds without interruption or delay to the final destination and there is at once discharged. Too often the car with its load is held on a siding while other cars pass on the main track. Too often, the car of coal stands on some track at the terminal point waiting the deferred moment of discharge. As an "empty" going back, there also may be delays. These affect mine operation because at the mine there may be right at that moment a shortage of cars.

When there are full and complete facilities for storage at both terminals, we may expect very extensive reductions of present coal troubles. Until such facilities are created, we may expect trouble. Even if we turn to the system by which all coal will be burnt at the mine and made to operate steam-electric plants and by which the current will be transmitted to the points where power, heat and light are wanted—even if we turn to this system, we will need storage at the mines, for the reason that the current will almost certainly need to be used at once because of economic reasons.

The railroad coal car in the United States is ordinarily a considerable affair, carrying anywhere from 40 tons to 100 tons of coal. Naturally, they vary in width, length and height, though not in the gage of track on which the trucks run. Some of the cars of older type have fixed bottoms; but this is not the case with the up-

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to-date, modern steel car. It discharges, automatically through the bottom, gravitation doing the work at the moment. The alternatives are hand discharge by means of shovels; grabbucket unloading; and the almost complete overturn of the loaded car. The car with an end-gate is confined pretty closely, I believe, to foreign countries.

Hand discharge is still in use, and may be expected to continue in use, because so many consumers and dealers are unequipped and will remain unequipped with suitable facilities.

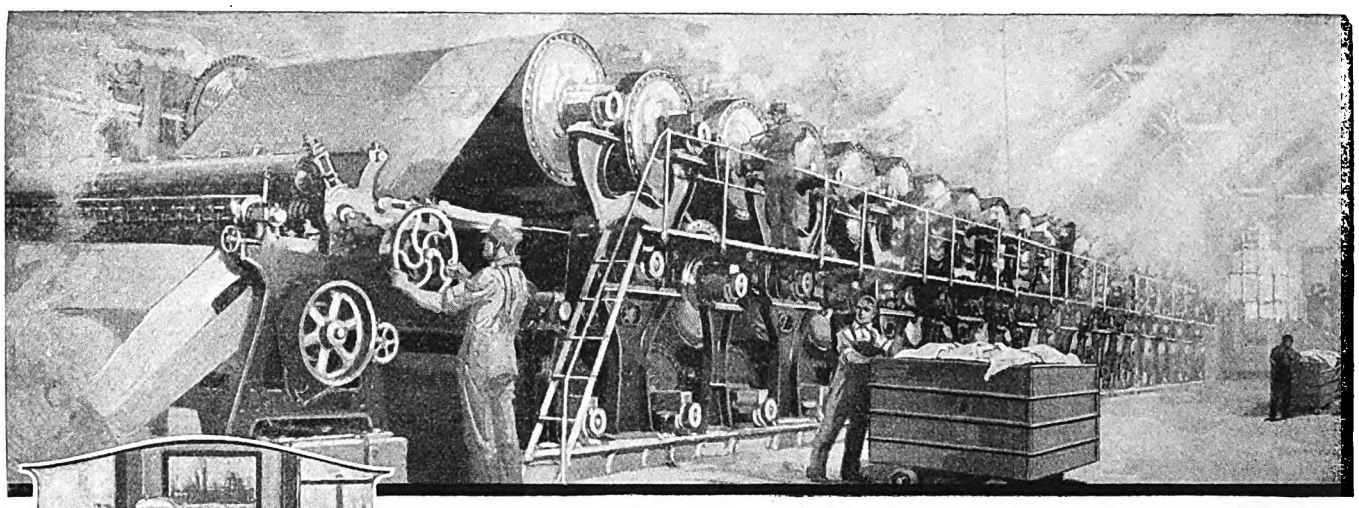
Usual methods of unloading coal make use of trestle-work and locomotive cranes. The loaded car or cars are run on a siding consisting in part of a trestle or other structure having space underneath. The bottom-dump cars are readily discharged. Cars with fixed bottoms may be unloaded by means of grab buckets operated by locomotive cranes.

The grab bucket is well suitted to this work, particularly the variety of bucket known as the clam-shell. The coal is not unduly broken up and good time can be made. However, the grab bucket can hardly clean up and take away the last of the coal. The ordinary showel may be used for this purpose.

Where the coal to be unloaded runs into large amounts daily, the mechanical apparatus known as the car dumper is one of the most effective means in use. As its name suggests, this machine picks up the car together with its load and overturns the whole. The car is overturned sideways and the amount of rotation may be as high as 160°. That is, the overturn may come within 20° of being complete. In England, it is customary with corresponding machines to tilt the car endwise and allow the coal to slide out at the end, an end gate having been previously removed. The slant of the bottom along which the coal slides may be 70°—that is, within 20° of the vertical. By the American system, the surface that is at 70° is the side of the car, and the length of the slide is at most from the bottom to the top edge of the side. There can be no doubt that the American method gets the coal out of the car much more quickly. In England, the car is tipped; in the United States, it is overturned. However, they make good time abroad. Their system would not be very suitable here, largely because it requires all cars to have end-gates.

The American car dumper handles cars of miscellaneous character—broad cars, narrow cars, tall cars, low cars, long cars, short cars. Naturally, the machine that handles them must be capable of much adaptation. In fact, the car dumper is a rather wonderful affair. Let me give some details.

The car dumper is used in such situations as a railroad water-front where large quantities of coal are to be delivered from railroad cars to storage spaces on board barges and ships. In some cases, as at New Jersey terminals on the water-front belonging to New York Harbor, the coal which flows into the apron of the car dumper from the overturned car finds its way at once into the barge moved alongside the tower of the machine. Similarly, at certain ports on Lake Erie, the car dumpers deliver directly to the whale-





In the manufacture of paper, huge clouds of steam arise from the heated rolls of the machine, and condense upon striking the roof and steel superstructure of the building. This moisture drips back on the newly formed sheet resulting in stains and weak spots which cause the sheet to break, effecting serious losses by interrupting production until the machine can be rethreaded. Being subjected to this dampness continually, also causes the roof to rot very quickly.

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Send rough sketch or blue print of building with data for engineer's analysis

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FOR more than fifteen years, Arex engineers, specialists in industrial ventilation, have been freeing manufacturing properties of profit destroying conditions.

Steam, heat, smoke, fumes, foul air—every conceivable situation has been under their surveillance.

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Dimensions of Building: Width.....Ft. Length.....Ft. Ceiling Height.....Ft.

Construction of Building: State whether Brick ☐ Concrete ☐ Frame ☐ Stucco ☐

Type of Roof: State whether Flat ☐ Slant ☐ Gable ☐ Sawtooth ☐ Monitor ☐

Pitch of Roof..... State how many..... inches to the foot .....

Location of Floor or Room to be ventilated.....

How high do adjoining Buildings extend over your Roof?.....

How many feet distant are the surrounding Buildings, or is your Building entirely unsurrounded? .....

..... Firm Name ..... Name of Individual ..... Title of Individual

..... Street Address ..... City ..... State

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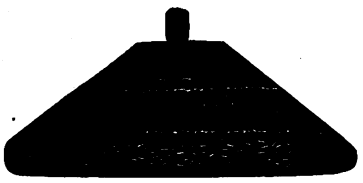
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The Lay Stapled Metal Case Brooms are made of the best materials the market affords and are *scientifically designed* and *constructed*. As a result they will do twice the sweeping possible with an ordinary broom and will do it better and faster.

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Originators of the Metal Case Broom.

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backs or other ships operating on the Great Lakes.

The car dumper may, however, be only a link in the actual transfer of coal from railroad to barge and ship. Thus, in the Hampton Roads district, on the Atlantic Seaboard, there are several very tall coal piers on whose elevated decks no railroad car runs. Big, special pier cars transfer coal from the land end out to points on the pier. These cars receive from the car dumper which is located on the shore near the land end of the pier structure. The special car operating under its own power, may require the loads of two railroad cars to fill it. When ready, it will, in a representative case, run the short distance from the dumper to a pier elevator. Here it is elevated together with its load, to the deck. It may then run under its own power to a destination out on the pier. Arrived here, it may discharge, through its bottom, to a coal pocket constructed in the pier structure underneath the track. Such pockets serve as temporary storage receptacles. The ship alongside the pier receives from the pocket *via* chute.

Some of the piers have decks about 90 feet above the water. Naturally, the expense of constructing such enormous affairs as these piers is tremendous. They are built tall in order to provide for gravity movement of the coal from car to pocket and from pocket to the highest hatch on the highest ship coming to the pier. Such ships, if the cargo of coal to be received is large, stand high above the water. If the ships are broad, then the height of the pocket must still be sufficient to carry the coal outboard a goodly distance as well as be above the highest hatch. Ninety and 70 feet seem to have covered the requirements at Hampton Roads.

At the New Curtis Bay pier in Baltimore Harbor, the car dumper is employed also in the way of a link in the chain of delivery. However, the car dumper does not deliver to pier cars but to a pier conveying belt. The delivery from the car dumper may be more or less indirect. The coal once on the belt is carried out into the pier. This is a long, low affair. Delivery from the pier to the ship is accomplished by

Keeps His Eye on The Score

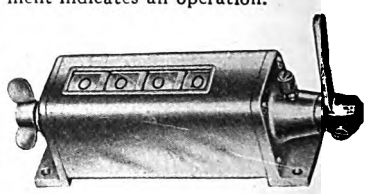
Any game a man plays, his eye is on the score. It's the same when he's operating a machine.

On the machine a Veeder Counter keeps the score. And your worker keeps his eye on it.

Maybe he's trying to *better* his record—at producing. Maybe he's only watching out to prevent a *poor* showing. In either case, his production is *HIGHER* because of a

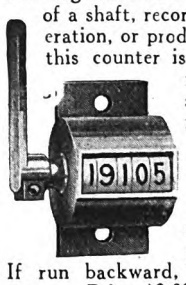
Veeder COUNTER

The Set-Back Rotary Ratchet Counter below is for machines such as presses and metal-stamping machines, where a *reciprocating* movement indicates an operation.

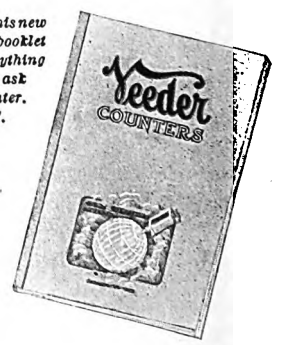


Registers one for each throw of the lever, and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price, with four figures, as illustrated, $11.50—subject to discount. (*Cut less than ½ size.*) Set-back *Revolution* Counter of similar model, $10.00 (list.)

The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation, or product. Though small, this counter is very durable; its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines, and most adaptable for experimental work. If run backward, the counter subtracts. Price $2.00. (*Cut 3/5 size.*) Small Rotary Ratchet Counter, to register reciprocating movements of small machines, also $2.00.



FREE—This new 80-page booklet shows everything you could ask in a counter. Ask for IT.



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power and not merely by elevation above the level of the hatches. At another port on the Southern Atlantic Seaboard (Charleston, S. C.), a somewhat similar conception has been put into effect. The idea is to get rid of the tremendous outlay required for a very tall pier.

There are a very goodly number of coal piers along the Atlantic coast which are of such types as to utilize the modern car dumper either not at all or only to a very small extent. Philadelphia and New York Harbors contain quite a number of the older types. They are wooden affairs and usually have no great height. They may, however, be considerable structures because of the length. Gravity delivery to the barges and colliers is largely depended upon. The railroad car goes out upon the deck of these piers. The movement of the cars to the decks is often, perhaps generally, accomplished by gravity. That is, the decks dip slightly toward the sea, although it is possible to have them dipped in the opposite direction. In the latter case, a locomotive is required to get the cars out on the pier, although this is not to be interpreted as necessarily meaning that the locomotive itself needs to go onto the pier deck.

It is very customary to use gravity as the means of shifting empty cars from a pier back to tracks on the land. This may be done in connection with car dumpers, especially in cases where the dumper delivers directly to vessels alongside the dumper tower.

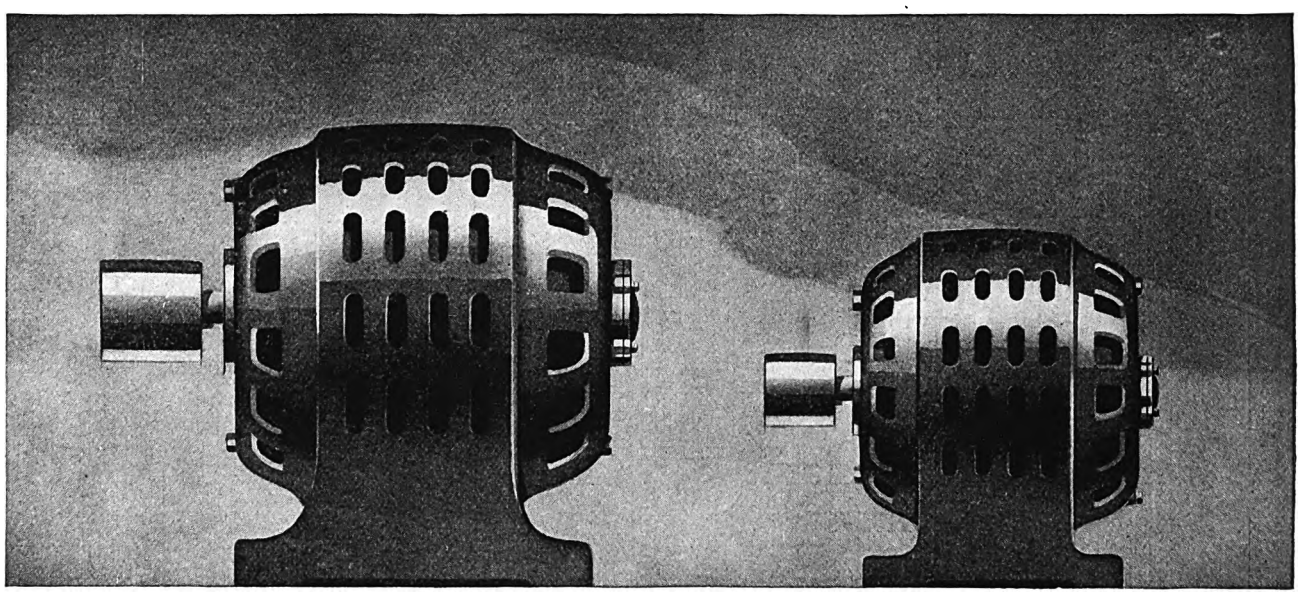
Coal delivered from rail to boat at New York has several destinations. It may go onto towed barges and then be moved to coal yards on the water-front, power-plants similarly situated, or to storage yards. It may also be delivered to sea-going colliers and barges for transportation to New England points. The New York Edison Company maintains a big storage yard and plant at Shadyside on the New Jersey bank of the Hudson River. Here coal is received by barge from railroad terminals located on New York Harbor, but further south. This coal is destined, perhaps all of it, to be consumed at Waterside power-plant, located on the *eastern* side of Manhattan, and so must be transported thither by barge. They can at Shadyside store enough coal to last anywhere from 6 months to a year. This is an example of what should be a more general adjunct to the plants of big consumers. This storage yard is equipped with its own elevated tramway for the automatic transportation of coal between the water-front and the storage regions of the yard. Coal dumped from the tram cars is, if necessary, piled at points nearby, by the grab bucket and locomotive crane method.

Let us return, however, to the car dumper. The reader may be interested in nothing the main features of operation. Consider a typical case.

The coal comes into the vicinity of the dumper, loaded on railroad cars. These may vary a great deal in size and shape. There will be a loaded yard. This consists of a lot of side tracks where loaded cars may be held. The tracks will

(*Continued on page 33*)

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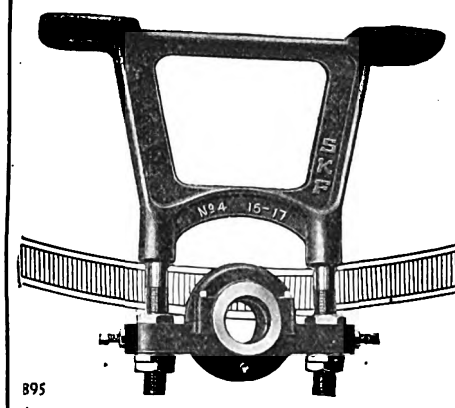
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The reduced power consumption is primarily due to the SKF marked self-aligning ball bearings used in Skayef hanger equipment. These bearings have two rows of highly polished steel balls operating between hardened races of steel, the inner race, balls and retainer being free to turn within the outer race like a ball and socket joint. This makes the bearing practically frictionless and immune from appreciable wear, not only when well aligned but also under conditions of misalignment that are so likely to occur in line shafting.

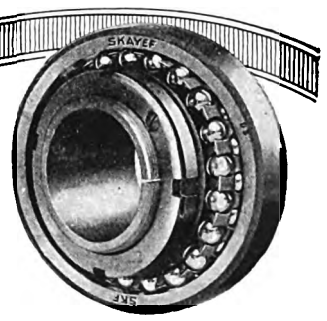
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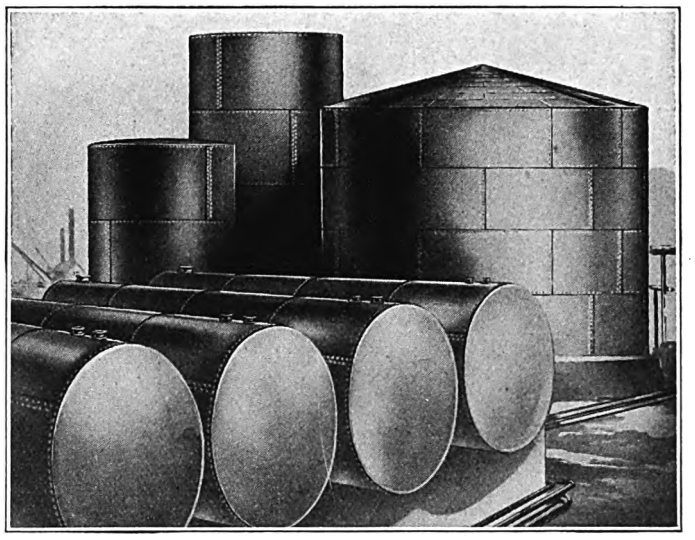
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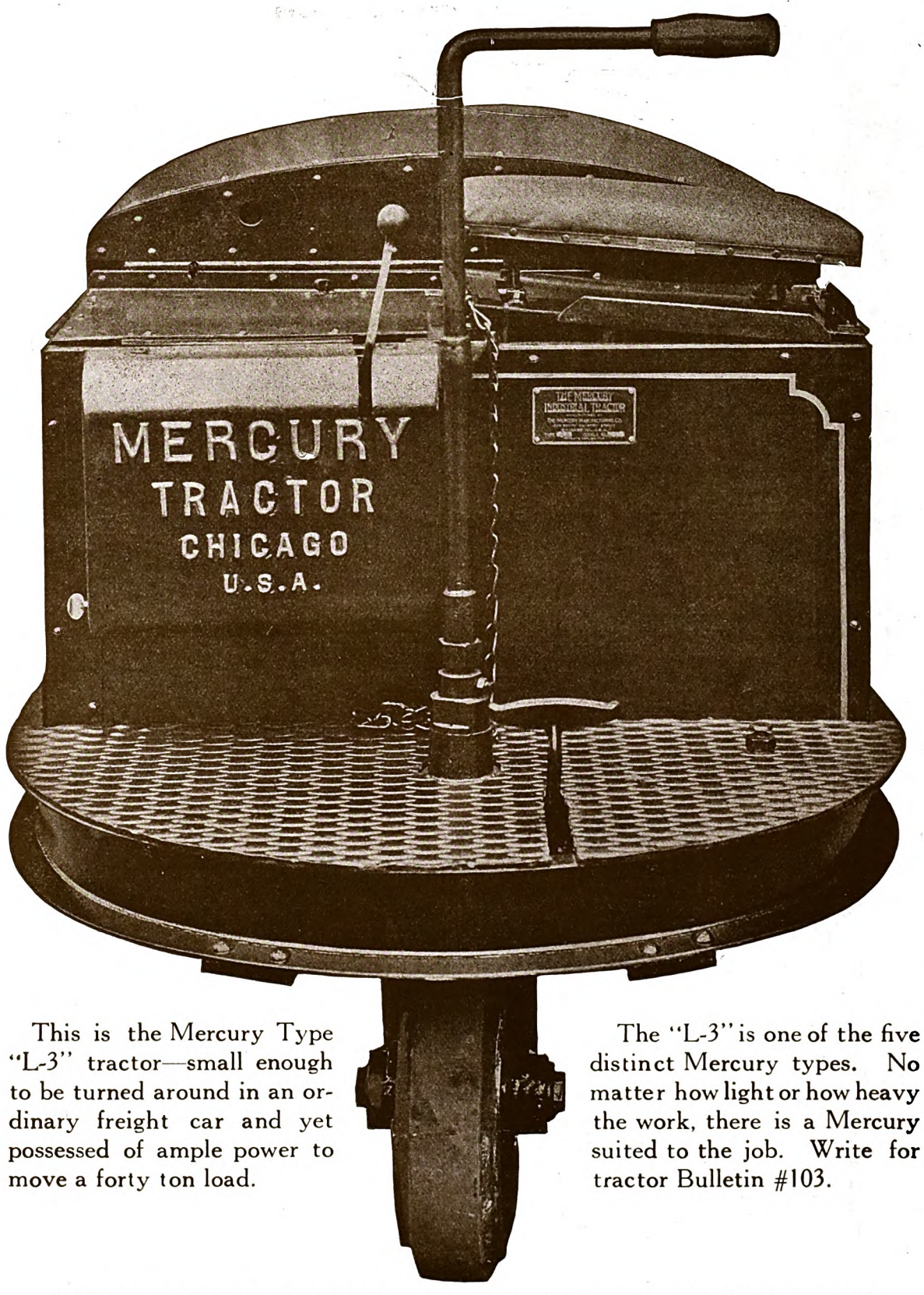
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(Continued from page 31)

be downgrade in the direction of the site of the dumper. A man will get up on one in a leading position, loosen the brakes and let the car go. As the car nears the dumper, the grade may drop down and up. The sharp down grade will serve to carry the car up the rise of the upgrade for a short distance. The upgrade tracks to the dumper will have a depressed narrow gage track between the rails on which the coal car is to travel up to the dumper. A small car, operated by cable, runs up and down on this narrow gage track. Its duty is to get behind a loaded coal car and push it up the incline. When it has pushed a car up to and onto the cradle of the dumper, it has performed its proper service and then returns to a position near the bottom of the incline and back of a new loaded car which has started up the hill. There are two methods of getting the little car—called a "ground hog," a "barney" or a "mule" —back to initial position. One is to let it run back under the influence of gravitation. But this method is, it appears, now becoming too slow to meet the requirements of certain plants; so the cable is used to bring the car back as well as take it up.

The new car coming up to the cradle should arrive just in time to shove forward the preceding car, now empty and on the cradle. The "empty" runs down a sharp declivity and immediately up against a "kick-back," the result of which is to send it on its way down and back to the general level where it will eventually arrive in the "empty" yard. Gravitation does all of this.

The loaded car which has just pushed an "empty" from the dumper cradle is now hoisted, the cradle serving as elevator car, until the predetermined point for overturning has been reached. The cradle is L-shaped in section cutting across the car. The loaded car does not stand directly on the platform formed by the base of the L, but on a movable platform resting on the base. On top of the movable platform is a short length of railroad track. Underneath, it is provided with wheels or rolls, and these run on the base of the L. When the car gets under way on the upward movement, the movable platform shifts so as to cause the side of the coal car to abut against the vertical wall or side of the cradle. The object here is to get ready for the overturning movement, which will be a partial rotation in the direction from the car to the side of the cradle. If a space of several inches were left until the overturn, there would be a shock when the load came against this part of the cradle structure. The loaded car is kept from falling out of the cradle during the overturn by means of wire ropes arranged vertically in front of the dumper tower. These are not permitted to come into immediate contact with the top edges of the coal car. That is to say, as the car is hoisted, it encounters several L-shaped bars, only the L is inverted. There is in fact a vertical part which extends downward from a point between the ropes and the car and also a horizontal part which extends over the top of the car. This horizontal part



This is the Mercury Type "L-3" tractor—small enough to be turned around in an ordinary freight car and yet possessed of ample power to move a forty ton load.

The "L-3" is one of the five distinct Mercury types. No matter how light or how heavy the work, there is a Mercury suited to the job. Write for tractor Bulletin #103.

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is grooved on top. When the overturn occurs, this groove engages a rope. As there are several ropes and L-shaped bars arranged along the length of the car, the result is that the ropes resist the weight which increases as the overturn continues. When the coal has all flowed out, the car, "cradle and all," are rotated back and let down to the initial position.

The Man Who Converted a Bark into a Bite

(*Continued from page 17*)

Hartford, can derive some satisfaction from the fact that at least it is they who make and sell most of Browning's guns, even if they did not originate them.

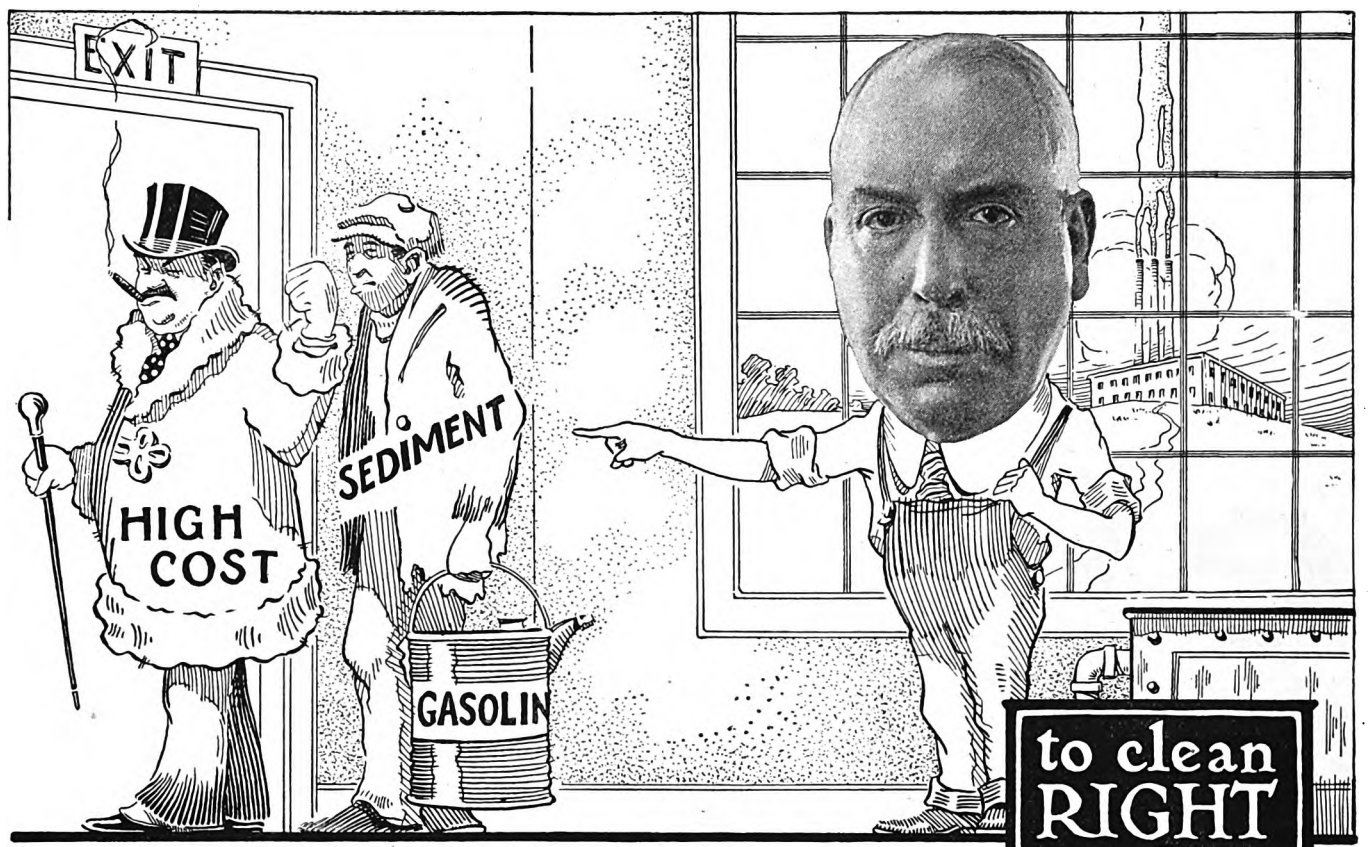
His first patent was granted in 1880 on a breech-loading rifle. He and his brothers made six hundred of them in their Ogden shop, and then Winchester bought the manufacturing rights. Since then he has developed most of their models. Remington acquired his auto-loading shot-gun and rifle. Stevens got his 12-gage repeating shot gun. He is responsible for all the well-known Colt automatic pistols. His pump gun has been mentioned. Whatever weapon Browning produced was so thoroughly right that the remarkable statement is made that not one of them ever has been superseded, even by his own later inventions; every one still is being manufactured and used by sportsmen and soldiers. Belgium bought the manufacturing rights to one of his army rifles, and when its arsenals turned out the millionth piece, in 1914, King Albert celebrated by decorating Browning with the Order of Leopold. Three other European governments adopted this American's guns for the use of their armies.

A Matabele chieftain once told a British army officer, who had had no easy job defeating him, that he did not object to the gun that spoke once (the rifle) or the little one that spoke six times (the revolver), but he could not withstand "the gun that kept on talking like an old woman, and never stopped." That was the machine gun. It is not quite so new as we are apt to think. On March 15, 1718, one James Puckle, of London, ("Gent" of course!) was granted letters patent on "a portable gun or machine" made of steel, iron and brass, mounted on a tripod of wood and iron, and bearing a startling resemblance to the most modern weapon of that type. The Turk was not any better loved in those days than now. The English Church litany had something to say about him, and Puckle designed his gun to shoot "round bullets against Christians and *square* bullets against Turks"!

By 1890 the United States government had adopted the Colt (Browning) machine gun, automatically operated by its own gas discharge, along with the hand-cranked Gatling. Machine guns had been used to some extent in the Franco-Prussian War, and European soldiers were using them in their wars with natives in Africa and elsewhere. But it was Americans whose genius, combined on a memorable occasion, made the machine gun a new arm of military service and created an epoch of tactical science. When Colonel Roosevelt and his Rough Riders fought at Santiago, Lieutenant John Parker had a few machine guns, most of them the now obsolete Gatlings, with one or two Colts. They were regarded as weapons of defence entirely. But American soldiers have a way of not doing things that always have been done, and Parker was one of them. The Americans, blazing away, heard the rattle of what they supposed were the Spaniards' machine guns, on the defensive. But soon Col. Roosevelt jumped to his feet, slapped his thigh, and yelled with joy to his men, "By Godfrey, boys, it's Parker! it's our own guns!" And when the line rushed forward, what did

(*Continued on page 36*)

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How JOHN BRIGHT rid the cleaning department of three pests

to clean RIGHT ask JOHN BRIGHT

IN the pressed metal division of a large automobile plant, the cleaner which was being used to remove mineral oil before japanning and stocking was leaving a deposit of sediment on the work, causing much trouble.

After trying another cleaner which was entirely soluble in water, with slightly better results, it was found necessary to clean some of the work with gasoline. The soluble cleaner required ½ hour of boiling to remove the mineral oil and the solution cost 7½ cents a gallon.

Finally they sent for me to rid their cleaning department of these three pests—High Cost, Sediment and Gasoline. Now my cleaner is giving entire satisfaction. It cleans in SIX MINUTES and costs only 3 CENTS A GALLON.

No matter what you are cleaning or what cleaner you are using, one of our forty compounds will save you time and money and improve the quality of your work. Let me prove this by shipping you a trial of the proper International Cleaner to meet your particular needs. Simply write me what you are cleaning. I'll do the rest. Trial order will not cost you a cent unless it does all we claim for it. Write me TODAY.

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PHILADELPHIA ~~~~~ PENNA.

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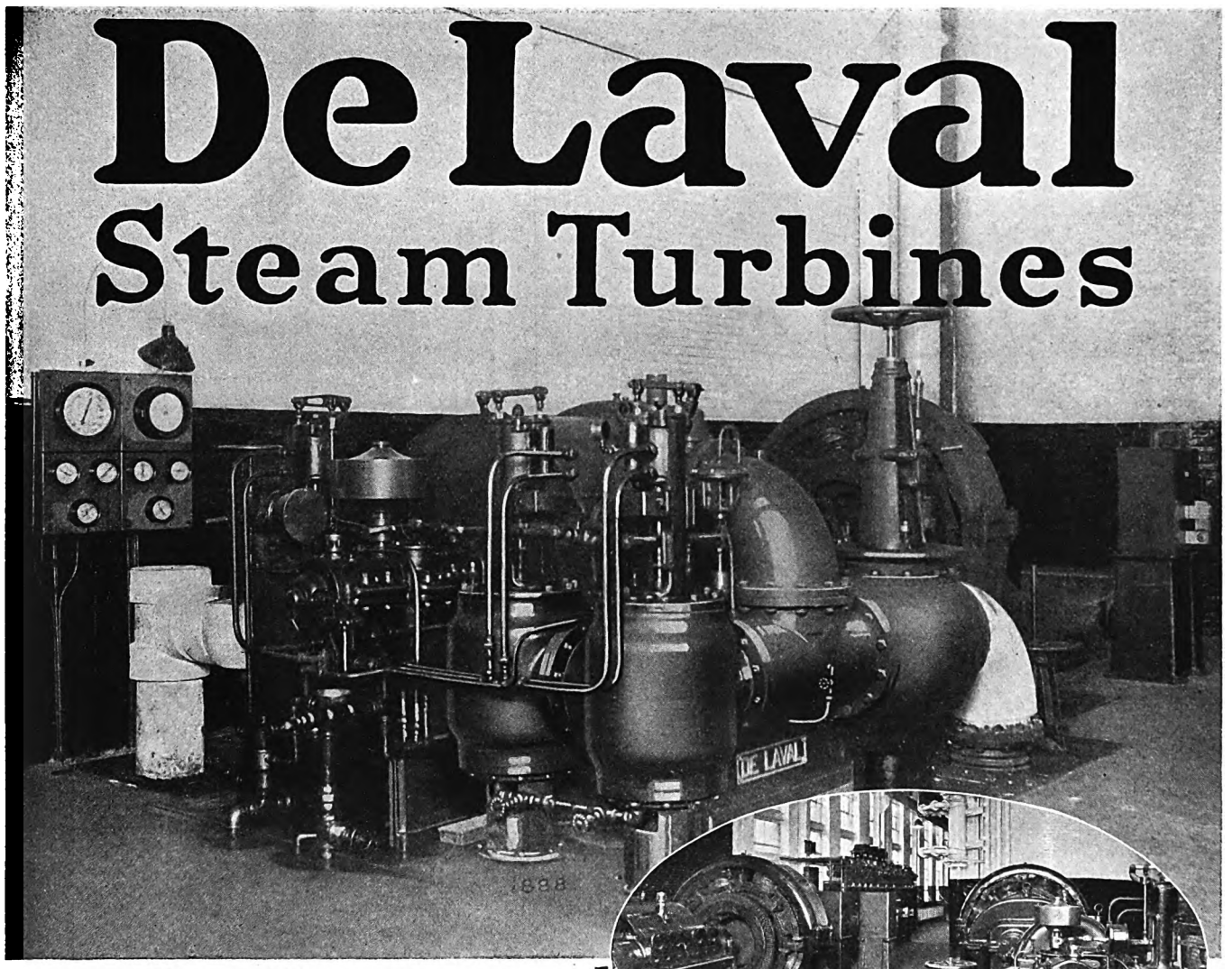
that young lieutenant do but pick up his machine guns and rush them forward, too, thereby converting them decisively into weapons of offense! They were heavy and cumbersome for this new duty, but Browning soon adapted them to it, and "Browning's Peacemakers," from then on, had a good deal to say, in more languages than one.

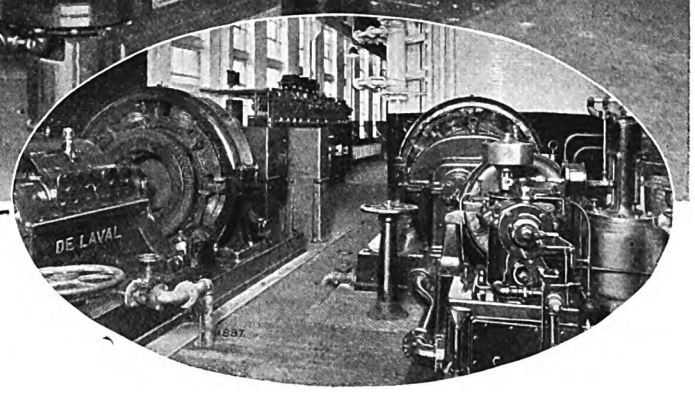
So when the Great War came on, machine guns were being used by all armies and for a variety of purposes in offense and defense. They would jam, however, at critical moments. When the United States decided to fight, John Browning decided that American fighters should have a weapon which would give them an advantage over the enemy, an arm that never would fail them. In a few months he had produced what the experts from the battlefields, when they attended its testing, pronounced "the finest machine gun in the world." Three of them, in fact: the light Browning machine rifle, weighing but fifteen pounds, carried by one man and fired from the shoulder or the hip; the Browning heavy machine gun, weighing, with its water jacket full, 34½ pounds; and the same gun, air cooled, for airplane use, weighing 22½ pounds, and firing through the propeller. Browning made a machine gun for the soldier to use under the conditions he met on the firing line, where there is no time for fussing with complications, and no repair shop handy. With fewer than twenty principal parts, it is taken apart and reassembled in less than five minutes and with no tools other than a small wrench and an empty cartridge shell. It operates on the power of the recoil. It ejects its discharged shell downwards, completely out of the way, instead of sidwise as other guns do, sometimes striking the next man in the face. No special ammunition is required; it uses the regular .30 caliber service cartridge, in a magazine of twenty or forty.

On February 27, 1918, the new gun had its test, under conditions more severe than it would ever meet in actual service, conditions which, as one officer said, would subject a soldier to court-martial if he ever permitted a gun to get into them. The barrels were corroded with acids, they had sharp dust, like emery, blown into them. They fired 20,000 shots with one, 39,500 with another, 20,000 with a third. One gun fired its stream of bullets for forty-eight minutes and eighteen seconds. And not once was there a jam. There were three stoppages, all due to the ammunition, and not to any failure of John Browning's mechanism to function.

Under the terrific strains of almost infinite energy in explosion and recoil, of changes in speed from absolute rest to the pace of lightning, of rapidity in the cycle of movements that makes "the twinkling of an eye" ridiculously slow, metal and gunpowder are as tractable as clay in the hands of John M. Browning. As distinguished from the student, the scientist, the philosopher, the statesman, the captain of finance and industry, he is their equal in a distinct field: he is supremely the craftsman, the mechanician, the artificer.

De Laval
Steam Turbines





Power From Heat Drop Instead of Water Fall

POWER can be produced very cheaply in a De Laval turbo generator which also supplies steam for heating, drying or manufacturing processes.

The accompanying photographs show three 1,000 kw. De Laval direct current geared turbo generators recently built for a cloth finishing plant. Two of the units are of the straight non-condensing type, supplying steam for manufacturing processes and heating. The third unit is a combined mixed flow and bleeder turbine, and serves to establish a balance between the exhaust steam and the power requirements, as it can either receive from, or exhaust into, the low pressure mains, or receive live steam and exhaust to the condenser, changing automatically in response to conditions.

Possibly our engineers can assist in improving the overall money economy of your plant by solving similar problems presented therein. De Laval steam turbines are of the velocity and pressure stage types, and are built in all sizes up to 15,000 hp., and for driving machinery at all speeds.

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Descriptive literature will be sent upon request:

DeLaval Single Stage Turbine: For High Pressure Condensing and Non-condensing Service. All sizes below 400 HP. Catalog A.

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DeLaval Double Helical Gears: All sizes, for all speed ratios up to 25 to 1 in one step.

DeLaval Centrifugal Pumps: Horizontal and Vertical, Single and Multi-stage. For all Heads and Capacities. Catalog B.

DeLaval Centrifugal Blowers and Compressors: Single and Multi-Stage. For all pressures up to 125 lbs. Catalog F.

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Quick starting and stopping do away with standby losses inseparable from coal-made steam power. Fuel is fed automatically, consumed only when needed and in proportion to the load. Ash removal expenses are eliminated and all labor is performed by one attendant.

Being a complete power plant in itself, the Fulton-Diesel performs every function in the cycle of power generation. One compact unit, it requires comparatively little room and does away with boilers, stacks, condensers and other steam plant auxiliaries.

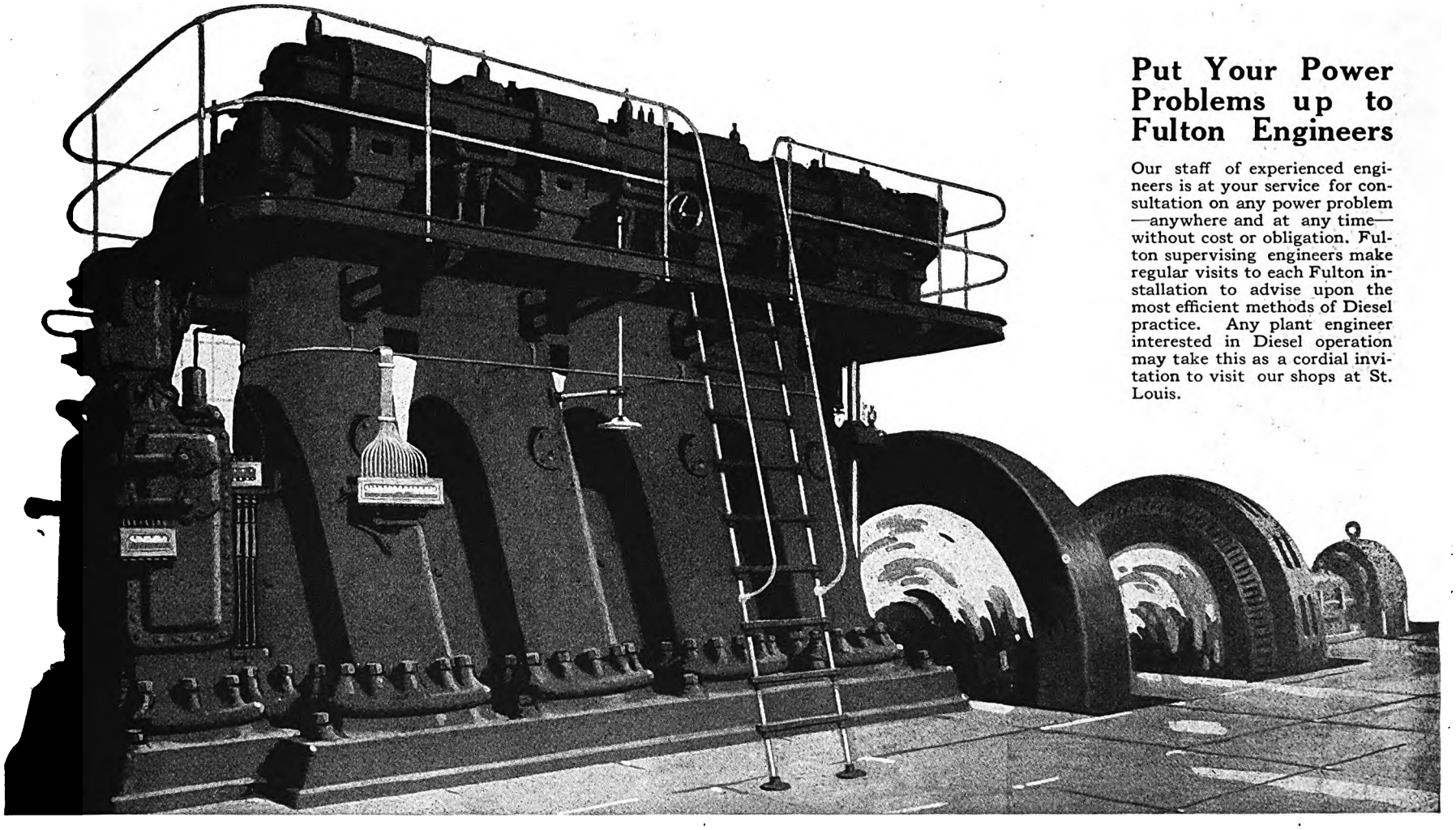
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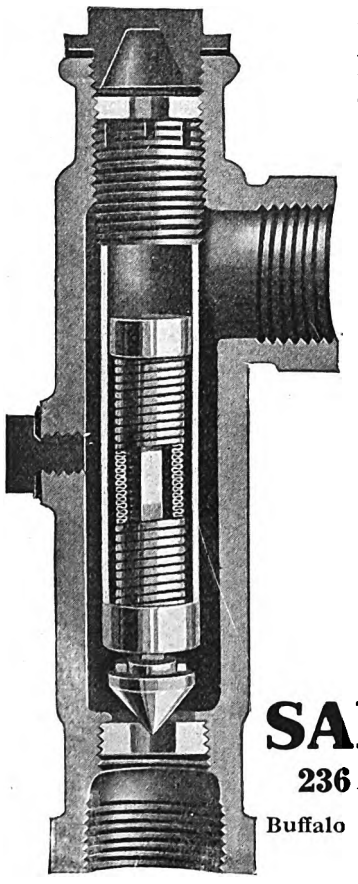


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SARCO CO., Inc.

236 Broadway, New York

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New Canadian Power Development at Niagara

(*Continued from page 26*)

the Niagara River and conduct it to a point on the Canadian side where it will plunge downward through penstocks and turbines and thence back to the Niagara River. It will avoid the Falls. The plunge downward just mentioned accomplishes substantially the same thing—namely, the drop from the Lake Erie level to the Lake Ontario level. The two drops, are not precisely the same, as at the Falls proper the drop is only part of the total between the two levels. Roughly, however, it is quite true that the diverted water has its Niagara Falls just back of the town of Queenston where the penstocks descend from the upper level.

This diverted water leaves the Niagara River at Chippewa, a Canadian town located near the natural mouth of the Welland River. It passes first of all through the bed of this river for a distance of about 4½ miles. It then enters the long power canal which conducts it to the head of the penstocks near Queenston. The Welland River is, in fact, diverted into this power canal. That is, that portion of the river not included in the final 4½ miles is diverted into the power canal, and Niagara River water comes from the opposite direction *via* the old channel of the 4½ mile section. So then, waters from the shortened Welland River and from the Niagara River unite and flow through the power canal. This is the plan that is being put through. What was the natural channel of the Welland River has water in it, some of which flows west to east, and some of which flows east to west.

The difference in level between the two lakes is 330 feet. It is expected to utilize 305 feet of this by a single drop near Queenston. Niagara Falls proper only drops about 162 feet—not much more than one-half of what is to be developed. The Canadians are taking advantage of the configuration of the country single plunge all that the Niagara River accomplishes in a which enables them to get in a long stretch.

The utilization of Niagara River water, whether on the Canadian or the American side, possesses a great advantage over the use of the water from many rivers that have had power development. There is generally a good deal of difficulty in maintaining an average flow. There will be an over-abundance at one time of the year and a great shortage at another season. In order to equalize matters, it is customary to construct one or more impounding lakes. In fact, the damming of upstream water may easily be one of the major items of cost in a power development. In some cases, no complete and constructed, whose duty it is satisfactory solution is possible at a reasonable outlay, and a duplicate generating station, operated by steam, is to make good any shortage of current from a small part to the whole of that required.

But hydro-electric plants along the Niagara River have back of them, as impounding reservoirs, all the Great Lakes excepting the smallest of the entire group. For this reason, the flow through the Niagara River is reasonably steady. The same may be said of the St. Lawrence River for the early part of its course.

When a power development is permitted to omit the control of the supply water, it is a great point in its favor. This the present development possesses.

Perhaps a slight qualification should be mentioned. The power canal which conducts the water from the point where Welland River and Niagara River water join to the head of the penstocks is widened in its later portion so as to provide a reservoir. The object is to secure uniformity of supply for the power-house. The size of this control-pool is very moderate, as it receives water with fair regularity.

It may be of interest to direct attention at this point to a financial matter. The first cost of a power development remains continually with the

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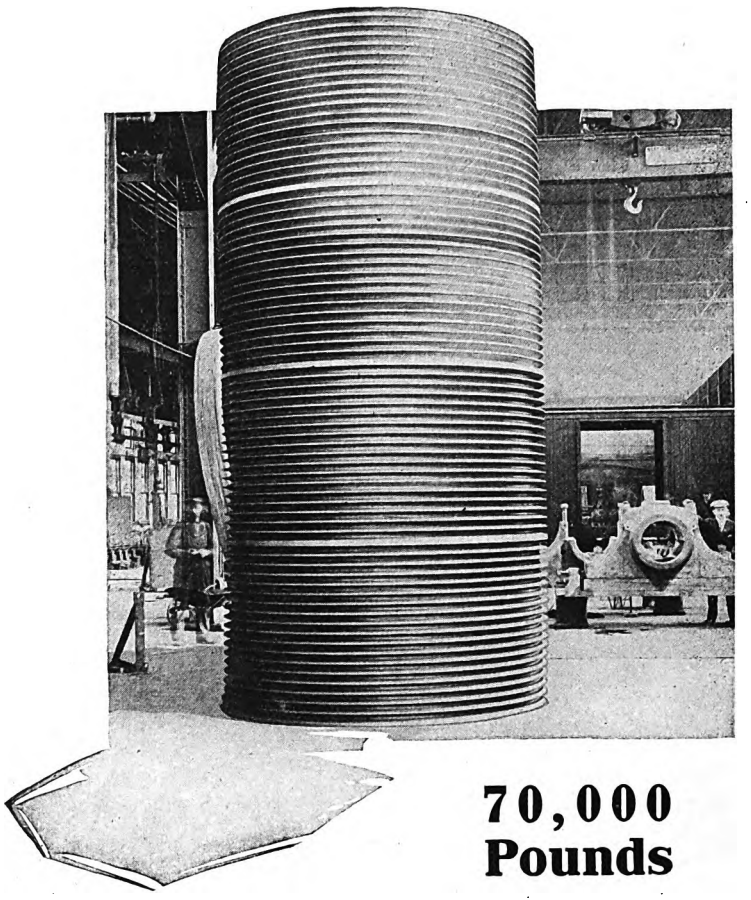
enterprise through its whole life—it does this in the form of interest on the initial investment. In fact, it may constitute a heavy drain on the revenues. When a big dam or a cluster of them may be omitted, the first cost is naturally reduced. This is by no means a negligible matter, as impounding dams may run into gigantic sums.

The decision between a hydro-electric plant and a steam-electric plant may become very close, chief items to be taken into account being the first cost of the engineering work in the one case and the cost of coal in the other.

The Niagara River is estimated as furnishing a total flow of 220,000 cubic feet per second. The international agreement provides for a withdrawal of 56,000 second-feet of the total for both countries. The Canadians get the larger share of this, 36,000 second-feet being their allotment. The new development, now occupying our attention, will be responsible for 10,000. The Canadians have, in other enterprises, absorbed about 18,000; so that 8,000 will be the amount available for future projects.

But, a unit flow of 1 cubic foot per second is not the same for all plants. This is to be accounted for by differences because of the topography and the like, and differences because of the design of the operating equipment. That is to say, the plants are not all on an equality with respect to natural and engineering advantages. With respect to the latter matter, the later plants have the possibility of utilizing advances in hydraulic engineering. The old power plants are understood to get from 12 to 15 horse-power out of a flow of 1 sec.-ft. The Ontario Power Company's development on the Canadian side is said to get 17 horse-power; and the Hydraulic Power Company's development on the United States side is rated at 20 horse-power. However, the Chippewa-Queenston development expects to realize 30 horse-power. This is a splendid result, and illustrates the differences that may result from a favorable combination of circumstances.

The margin between 305 and 330 feet is merely 25 feet. This



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is the loss in head due to various causes. Twelve feet are accounted for in the 4½ miles between the Niagara River and the control works at the southern terminal of the power canal. Then the power canal itself accounts for 8 feet more. Two feet are to be allowed for the difference in level between the power house and Lake Ontario. Three feet of head remain. Of these, one-half foot is allotted to friction in the canal and 2½ to friction in the penstocks.

The rate of flow in the river bed is naturally much slower than in the power canal, largely because of the great difference in cross-section. An average velocity of 2 feet per second is estimated for the river section. This would mean a cross-section of 5000 square feet. The average in the power canal is put at about 6½ feet per second, which divided into 10,000 cubic feet per second gives 1538 square feet for the cross-section. The power canal runs, roughly, north over a route not much involved in changes of levels at the surface. It is consequently possible to construct a channel in which the cuts are not especially deep. Through a large portion of the total of 9 miles, the canal has its bed in the rock. However, at a point opposite the celebrated Whirlpool in the Niagara River below the Falls, the rock is too far down. The conjecture has been expressed that the sudden falling away of the rock level at this point is to be ascribed to the presence of a gorge formerly occupied by the Niagara River.

The outline of the cross-section of the canal excavation varies a good deal from place to place. In fact, there are no less than half a dozen representative sections. At the southern end occurs a section where the horizontal bottom of the canal is 70 feet wide. The banks have a moderate slope. The entire prism of the canal is at this point in the earth. To protect the banks, heavy rip-rap is employed as a facing.

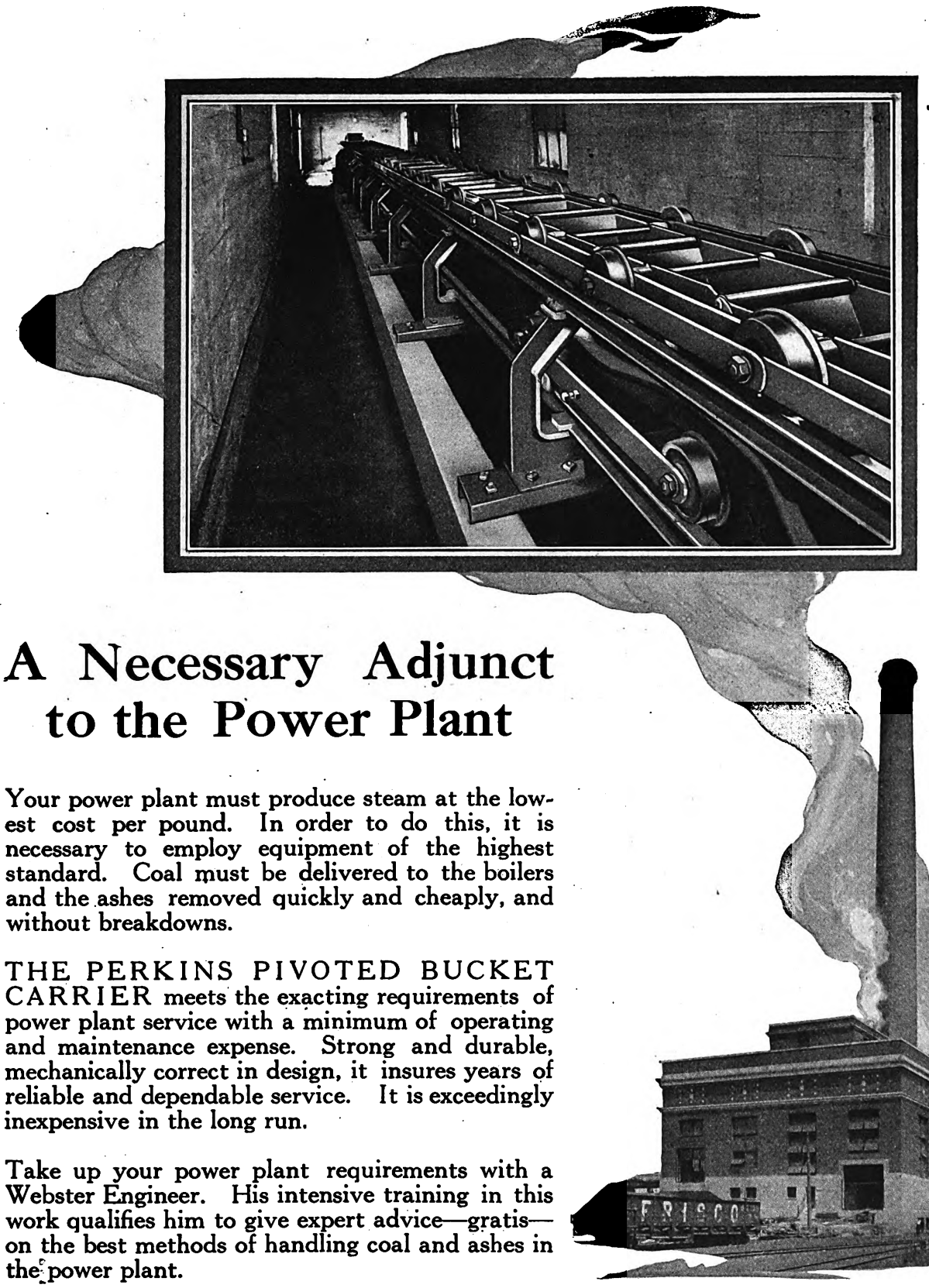
Further on northwards, the canal has a good part of its section in the rock. There is, however, a stratum of earth at the top. Here, the lower part of the canal has a rectangular rock section. The earthen banks of a moderate steepness begin to rise not at the edges of the rock excavation, but some distance back. There is thus a kind of a berm or ledge on each side.

Further north, the rock is covered by a thicker stratum of earth. The rock excavation is here narrowed. Still further north, we find both earth and underlying rock. But, artificial walls are here erected on the natural rock berms and thus carry the rock portion of the section to a higher level. These walls are filled in at the rear.

Going on further north, we find the canal section a very flat V; while near the power house where nearly the whole section is in rock, it is a simple rectangle.

It will be gathered from the foregoing that the form of the power canal is quite diversified in the course of its nine miles of length. That this diversification is due not to caprice and love of variety on the part of the engineers should be granted on general

(*Continued on page 42*)



A Necessary Adjunct to the Power Plant

Your power plant must produce steam at the lowest cost per pound. In order to do this, it is necessary to employ equipment of the highest standard. Coal must be delivered to the boilers and the ashes removed quickly and cheaply, and without breakdowns.

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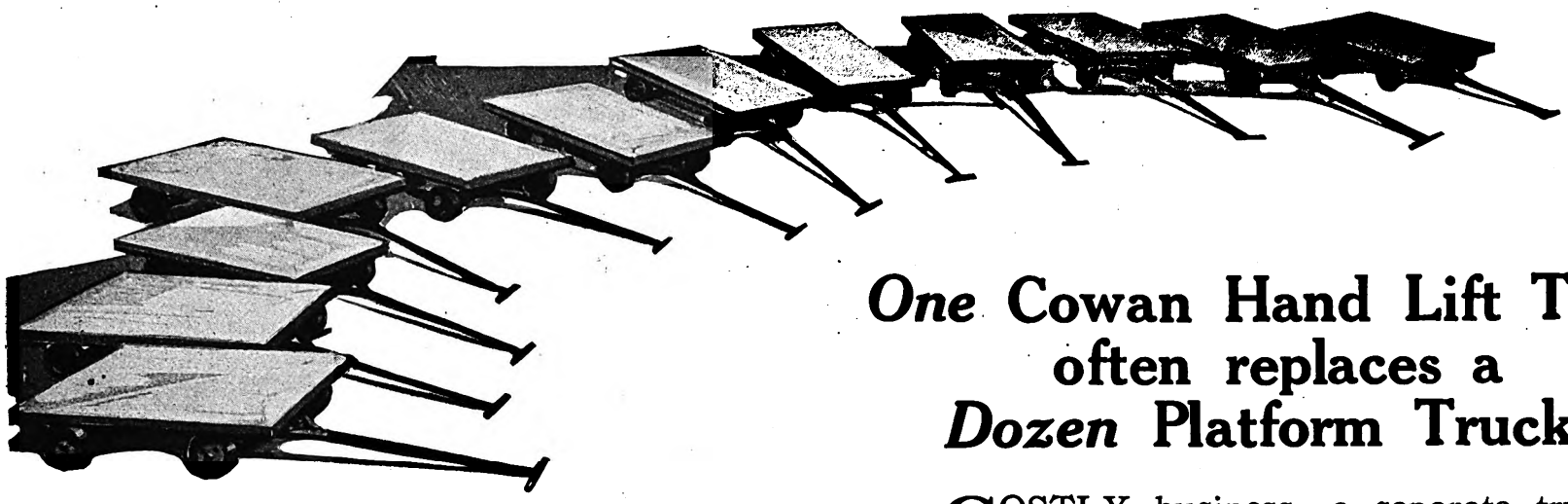
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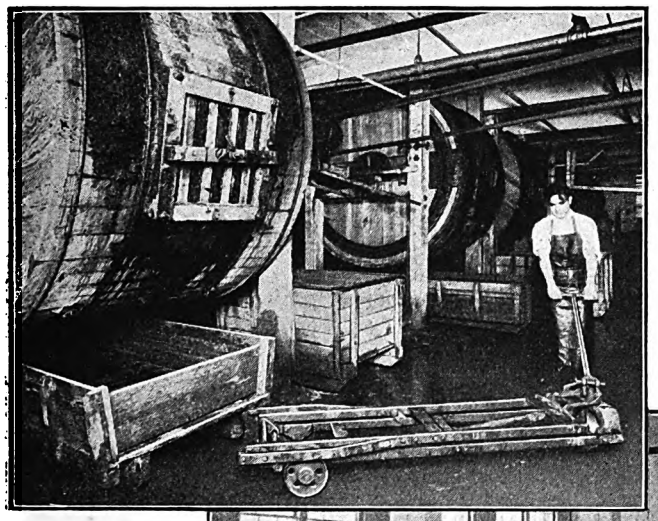
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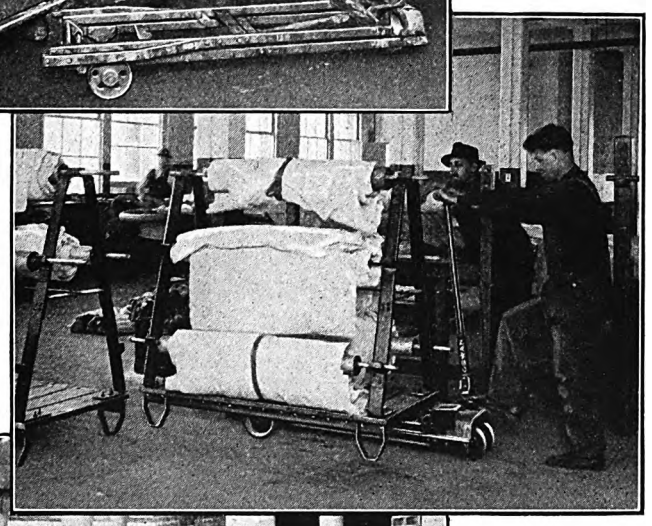
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One man and a *single* Cowan Hand Lift Truck can serve any number of loads mounted on skids. Skid and load automatically picked up by pressure on foot pedal and single downward movement of truck handle. Again pressing on foot pedal lowers skid and load to floor. No rehandling of load when moved from point to point.

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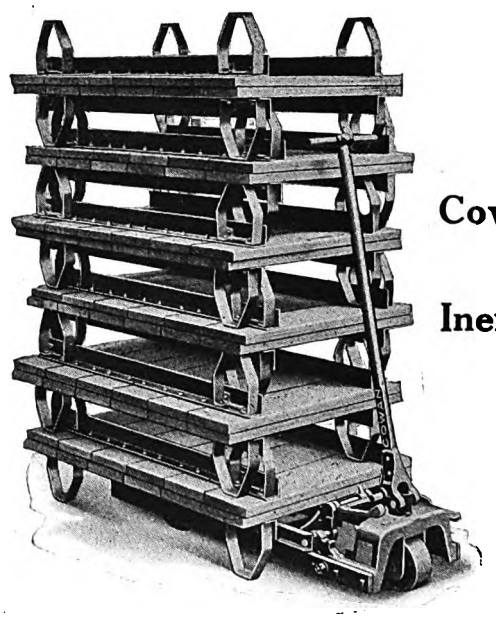
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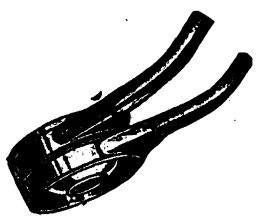
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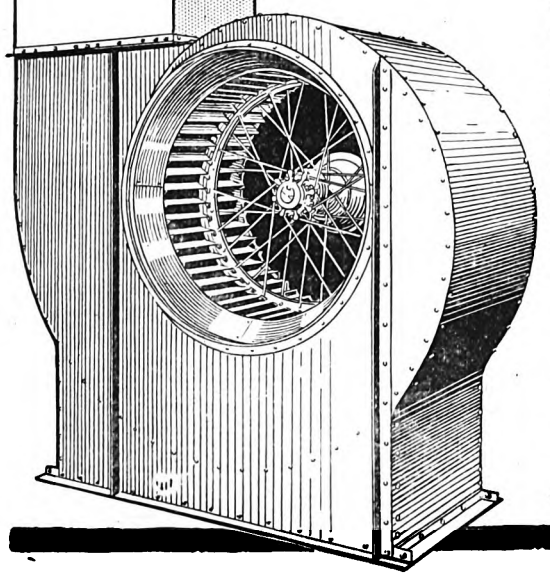


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(*Continued from page 40*)

principles. It can be accounted for by such homely considerations as the purpose to use a section involving the minimum of expense. This would vary with the location and character of the rock.

The character of the excavation required is also quite varied. This is due not merely to the changes in rock and overlying earth along the route of the power canal, but also to the fact that wet excavation has been in demand. This wet excavation is mostly in the old channel of the Welland River. This 4½-mile stretch must be made definitely to conform to the general requirements. Through this channel, for example, a definite flow of water must be withdrawn from the Niagara River and passed on to the power canal. There is a 12-foot drop in the 4½ miles. The problem that had to be solved was perhaps not especially difficult. It required a moderate modification of the river bed of such character that the necessary flow could be gotten with the gradients possible within the 12-foot limit for the 4½ miles.

The excavation necessary to bring the river bed to the engineers' lines has been going on by several methods. Thus, the cableway has been employed, together with the grab bucket. Then, dredges have been utilized in the work. And a certain amount of wet excavation has also been carried out at the southern terminus of the power canal. Here the first of the nine miles of canal lies above the rock. Back in the fall of 1920, it became desirable to get excavation going promptly in this region. The dredge competent to the work and otherwise available was in the control of the harbor authorities at Toronto on the northern side of Lake Ontario. The shifting of this great suction dredge to the scene of operations in the cold season was an interesting problem. It illustrates the unexpected requirements that construction people have to meet. The dredge had to be brought across the western end of Lake Ontario, through the Welland Canal and its many locks, along Lake Erie, along the Niagara River, through the portion of the Welland River which was to be reversed. Two tugs assisted in the transfer. Ice had at times to be cut away that was 4 to 6 inches thick, and the dredge itself deepened its own pathway for a portion of the shallow part of the channel and a separate dredge excavated a portion. All difficulties were overcome or set aside, and the dredge got duly to its station and has participated in the construction of the power canal as desired.

A great deal of concrete goes into the work. Naturally, the power house requires a large amount. But even aside from this use, concrete has been much employed on the work. Some of the slopes of the power canal have been protected with rip-rap. But rip-rap can not be used on very steep inclines. Concrete has been used on similar slopes, where it was more convenient or cheaper or where the slopes were rather steep. Concrete has also been used to provide a protective and smooth face for vertical walls.

A rather novel method of placing concrete was used on a section of the power canal near the Whirlpool of the Niagara River. The slopes are both high and steep. While concrete is perhaps the most useful of all construction material, its usefulness here was, for a time, somewhat at a discount, because of the cost in time and money involved in the form work. The vertical height to be covered was 54 feet. The slant was such, however, that the slab of concrete required measured 83 feet from base to top. One method employed proceeded by constructing concrete panels on the slopes that were narrow and parallel. These were 1 yard wide and the intervals between were 5 yards wide. The filling in of these was done with the aid of wooden forms. That is to say, a flat wooden form 16 feet long and three feet wide would be placed so as to bridge at the bottom the interval from one concrete panel to the next. Then the space back of the form would be filled with concrete. Later, the form would be shifted to a higher position, and 3 feet more of slant height filled in. In this way, the big panel 15 feet wide and 83 feet along the slant would be constructed.

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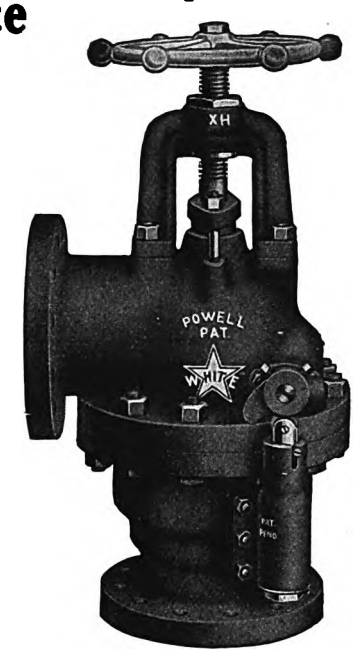
are a combination of the most serviceable mechanical factors insuring to the user unfailing dependability.

Two reasons for their long life are their regrindable, renewable disc, both cast of Non-Corrosive Powellium Nickel.

Medium and extra heavy for steam working pressure up to 200 and 300 pounds.

SEND FOR DESCRIPTIVE CIRCULAR

Fig. 2228



The Wm. Powell Co.

2525 SPRING GROVE AVENUE CINCINNATI, OHIO

Photographic Record Paper

For COPYING MACHINES

Back to Pre-war Prices

THE RECTIGRAPH COMPANY manufactures its own photographic copying machines and coats its own photographic paper, the entire plant being devoted exclusively to this line. Due to a lowering of the prices of some materials and economies effected in our new plant, we are enabled to announce a reduction of 20% from the prices prevailing on photo-copying paper for some time past.

Revised Prices on Rectigraph Paper

ROLLS 350-FT. LENGTH

8½-inch width	$10.68
9½ " "	11.93
11½ " "	14.00
12¼ " "	15.45
13 " "	16.00
14 " "	17.59
15 " "	18.84
18 " "	22.00
18¼ " "	22.90
24¼ " "	30.45

F. O. B. ROCHESTER, N. Y.

Rectigraph emulsions are coated upon a high grade 100% rag stock, producing excellent results with a durable base. Rectigraph paper is a contrasty bromide paper with excellent orthocromatic qualities, and will reproduce colors perfectly. All the speed consistent with good quality.

The RECTIGRAPH COMPANY has always regarded acceptance of an order as a pledge that it would be filled at the earliest possible date. The output of our plant belongs to our customers with orders on our books. This policy compelled us, during the past few years, to decline much desirable business which would have been highly appreciated, but this could not be considered without prejudice to previous connections. Improved facilities in our new plant enable us to increase production and quality and to decrease manufacturing costs. ***Our Customers will benefit.***

It may be to your interest to become acquainted with Rectigraph paper. We would be glad to receive your order for a sample roll, spooled to fit your photographic apparatus. You can then judge of its merits.

Rectigraph Company

(An Independent Corporation)

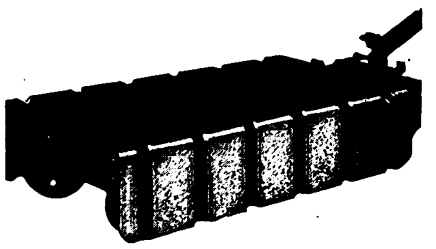
ROCHESTER, N. Y.

vised. As it represents an advance in the development of concrete practice, it is worth noting. The procedure was based on the use of a steel form of much larger size. It had one dimension of 16 feet as had the old wooden form, and this provided for bridging the inter-panel space having a width of 15 feet. But the other dimension of the steel form was made 17 feet. Naturally, a large flat form of this description had to be backed with suitable ribs. Two of these on the two sides were prolonged upwards and then brought together, the whole forming a draw-bar by means of which the form might be drawn up and let down. A winch was set up above and a suitable rigging arranged. In doing the concreting, the bottom would be done without this steel form and in the usual way. In this manner a bottom layer, measuring perhaps 20 feet up the incline, would be put in. Then the steel form would come into requisition. The winch would be started up, resulting in a very slow upward movement of the steel diaphragm. Concrete would be poured in at the top and the vacant space kept more or less filled. The new concrete would show below the base of the moving form before it had gotten very hard. There was advantage in this, as it gave the workmen whose duty it was to finish the surface of the concrete slab, opportunity to do their work while the concrete was still in the green state. It is understood that by this method a more uniform surface and a better finish were obtained. Some speed was attained by the new procedure. Thus, a slab measuring 55 feet up the slope was poured in the space of 10 hours. If this represents the actual time of concreting, without allowance for a meal, then the average speed of movement up the slope was 1.1 inches per minute. It will be readily seen that such a slow movement would not interfere with the pouring in any real way.

It has been found possible in carrying out the excavation for the power canal to use the channeling machine. This is a device in considerable employment in certain quarries where it is important not to waste the rock by more blasting than is

TRUSCON ALLOY PLATFORMS STEEL

Used in connection with lift Trucks



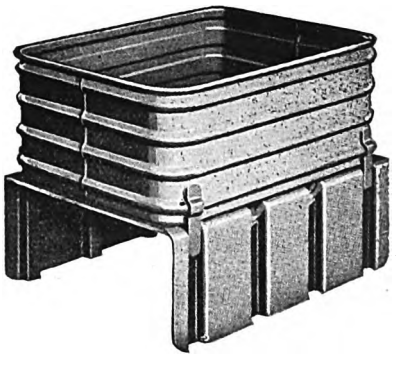
Because of Their Convenience

Every time materials are placed on the floor, money is wasted. To lift and place them costs money, and to set them down costs money. More than half of this constant expense is avoided by using the Truscon Alloy Steel Platform. To place the materials on a platform is even easier than to put them on the floor. Moreover, the hand operations of lifting the materials from the floor and piling them on the truck are altogether eliminated. The platform when loaded is quickly moved along by means of a lift truck.

Because of Their Durability

Any platform will save money in the ways described, but the maximum economy is secured thru the use of the Truscon Alloy Steel Platform. Formed of one piece of heavy gauge pressed steel stiffened by deep ribs, the Truscon Alloy Steel Platform stands up under hard use and saves repair expense. It does not get out of order nor wear down like wood; its clearence height remains uniform and the full width is available for inserting lift truck. Furnished in numerous sizes to meet varied conditions.

Truscon Boxes for Steel Platform



Skeleton boxes fitting any size platforms are furnished in various depths. They are either welded securely to the platform or equipped with steel stakes which slide into the ribs of the platform. Made of heavy gauge steel, reinforced with deep stiffening ribs and flanged edges. We make boxes to meet every requirement.

Tell Us Your Requirements for Anything in Pressed Steel Parts

Truscon Steel Company

YOUNGSTOWN, OHIO

Sales Offices in Principal Cities

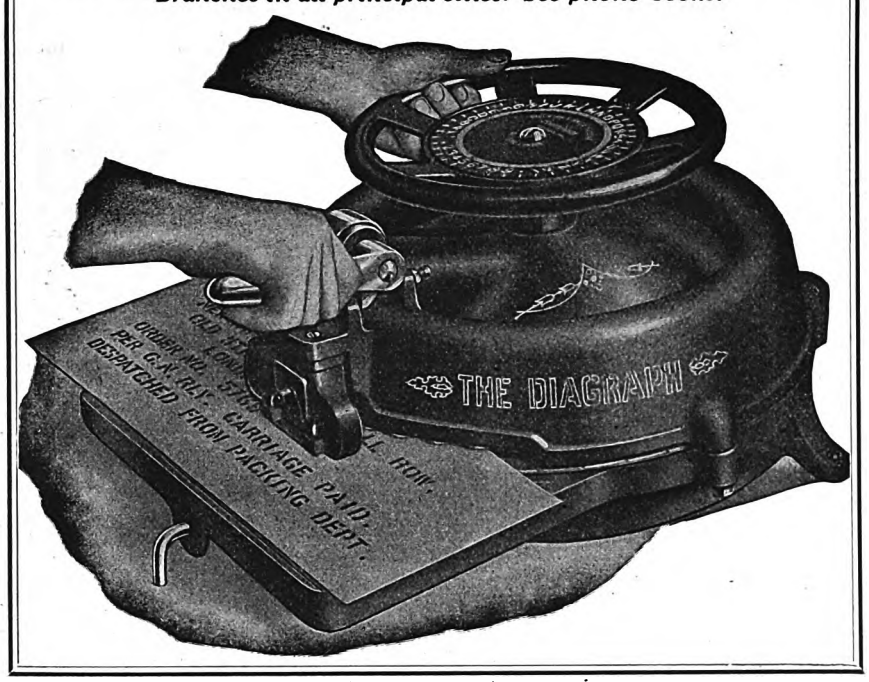
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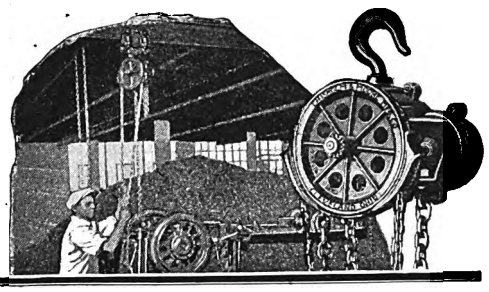
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YOUR SHIPMENTS

The Diagraph cuts legible address stencils for marking all packages, boxes, bags, cans, crates, castings and similar material. Addresses do not blur, wash or rub off. Safer than tags. A practical insurance against lost and delayed shipments.

Try one free in your own shipping room—price complete with all supplies, only $110.00 delivered, in either housed or open models. Order one on trial—no obligation to buy—we pay all charges.

DIAGRAPH STENCIL MACHINE CORPORATION
1625 So. Kingshighway Blvd., St. Louis, Mo.
Branches in all principal cities. See phone books.





CYCLONE HIGH SPEED HOISTS

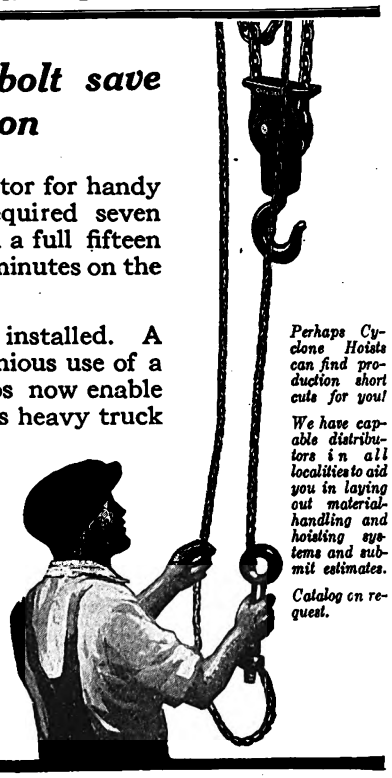
—plus one man and an eyebolt save 102 minutes in one operation

TO invert this 3200-lb. industrial tractor for handy assembling operations formerly required seven husky men,—and the job consumed a full fifteen minutes. 7 men, 15 minutes,—that's 105 minutes on the time keeper's record.

Two Cyclones on overhead trolley were installed. A few whirls of the hand chain, and the ingenious use of a removable eyebolt to get the proper grips now enable one man to deftly pick up and invert this heavy truck in 3 minutes by the watch—a clean saving of 102 minutes on just one operation.

Don't think this saving an unusual one. Cyclones show surprising savings wherever they replace strong-arm methods!

The Chisholm-Moore Mfg. Co.
Cleveland, O.
HOISTS CRANES TROLLEYS
Branches: New York Chicago Pittsburgh



Perhaps Cyclone Hoists can find production short cuts for you!

We have capable distributors in all localities to aid you in laying out material-handling and hoisting systems and submit estimates.

Catalog on request.

necessary and to get the blocks in rectangular forms. It cuts a narrow and deep slot in a vertical plane. In ordinary engineering work, there has apparently not been found much service for this type of machine. The reason doubtless turns on the infrequency with which rather perfect vertical walls must be had in rock excavation work, and upon the natural instability of a good deal of the rock whose excavation is wanted. However, upon this Canadian enterprise, there is a good deal of fairly stable rock at points where vertical walls were wanted or were permissible. The method is slow and precise.

For general excavation in the dry, the steam shovel has been largely relied upon. It has been said in effect that the chief steam shovel in use on the enterprise was the largest in the world. This American-built machine is of such great size that an ordinary shovel is at times sent ahead as a pilot. The advance shovel digs out a small cut and the giant to the rear opens it out and does quantity work.

The initial equipment at the power house consists of two big 55,000 horse power turbines with generators to match. The penstocks which conduct the water from the forebay on the Lake Erie ledge down to the turbines are immense steel pipes 14 feet in diameter and about 450 feet in length. It should be understood by the reader that it is quite the custom to install less than the whole of an ultimate power equipment in order to keep the investment as low as possible. When the business develops and more current is in demand, other power equipment may be installed.

A Novel Solution of the Dust Explosion Hazard

(*Continued from page 15*)

and the tremendous loss of grain, has never been accurately determined but has been estimated at approximately, $3,750,000.00. It is certain that many millions have been spent in the rebuilding of this elevator.

In connection with this reconstruction work it is of extreme interest to note what steps were taken by the engineers in charge to prevent a recurrence of this disaster. The chief precautionary measure was the installation of a mammoth pneumatic sweeping system by means of which the heavy precipitation of dust on the walls, floors and other interior surfaces may be collected and whisked away by means of powerful air currents (or artificial winds) through a system of piping and thence to huge separators which separate and confine the dust until it is safely removed.

On first thought it would seem that the sweeping of floors by the suction process would be in the nature of a secondary measure and that the dust should be collected at its source, or confined and not permitted to escape. This is entirely correct from the theoretical standpoint, but in the handling of grain a large volume of dust is given off each time it is moved so that in spite of the most modern dust exhausting systems, a large percentage of the dust escapes into the air, whence it settles on the floors, walls, etc.

A striking feature of dust explosions is that there are always two explosions, viz., the primary and secondary. The primary explosion is that of the dust which is suspended in the atmosphere and is seldom destructive in its effects but if the building is heavily charged with accumulations of "static" or settled dust, this concussion of the primary explosion serves to agitate and stir up the accumulated static dust, which then explodes, making the destructive secondary explosion.

Obviously, if the building is kept clean and free from accumulations of static dust, this danger of the secondary explosion will have been eliminated.

This briefly explains why it was considered so important

(*Continued on page 46*)

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Production Starts with Your Coal Pile!



Power plant of Bird & Son, Walpole, Mass., G-W equipped throughout.

Efficient Production Requires Efficient Fuel Handling

Constant, effective, low-cost power is an important factor in economical production. And it is often a considerable factor in establishing sales price schedules that get the business.

Gifford-Wood equipment ensures permanently economical handling of coal and ashes. You can bank on it year after year to handle fuel quickly, at low operating cost, and with almost negligible maintenance and depreciation. Is your power plant fuel and ash handling a source of profit—or just an item of expense? G-W Engineers are "profit building" engineers. Can they be of service to you?

G-W PRODUCTS

The Gifford-Wood Company specializes in elevating and conveying machinery for all lines of industry. These products include coal pockets, screens, hoppers, locomotive coaling stations, elevating and conveying equipment for ashes, stone, sand, gravel; wagon loaders, portable belt conveyors, pivoted bucket carriers, warehouse conveyors, car unloaders friction clutches, hoists.

MAIN OFFICE AND WORKS: HUDSON, N. Y.

New York: 50 Church St. Boston: 24 Milk St.
Chicago: 565 W. Washington St. Buffalo: Electric Bldg.

Gifford-Wood Co.

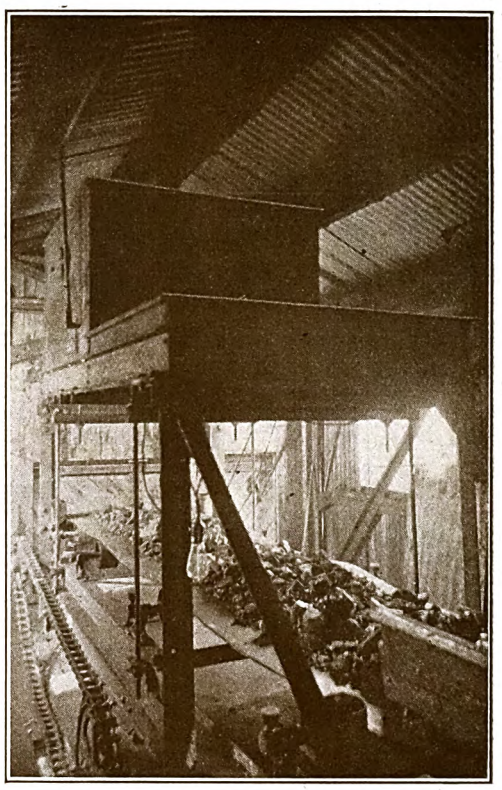
MATERIAL HANDLING EQUIPMENT

SAVE TIME AND LABOR

Use The

MERRICK CONVEYOR WEIGHTOMETER

Any material which is conveyor handled can be weighed without additional handling or loss of time by the Merrick Weightometer.

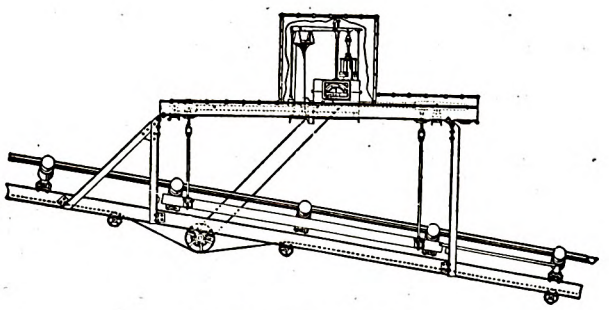


TYPICAL INSTALLATION MERRICK WEIGHTOMETER

Hundreds in use weighing all classes of materials such as

coal, run o'mine and crushed.
Coke
Stone, coarse and fine.
Gravel.
Sand.
Cement Rock.
Cement Clinker.
Metallic Ore.
Phosphate Rock.
Phosphate Pebbles.
Wood Chips.
Sulphite Pulp slabs.
Fish and Fish Products
Finished Cement
Zinc Ore,
Iron Ore.
Copper Ore.
Lead Ore.
Gold Ore.
Silver Ore.

NO WEIGHMAN OR ATTENDANT REQUIRED
GUARANTEED AND PROVEN
99% ACCURATE



Method of Installation

Why rely on Bill of Lading Weights?
Why not be able to tell exactly how much material you receive?
Hundreds of concerns buy and sell their products using Merrick Weightometer weights.

For Information Write

MERRICK SCALE MFG. CO.,

180 Autumn Street **PASSAIC, N. J.**

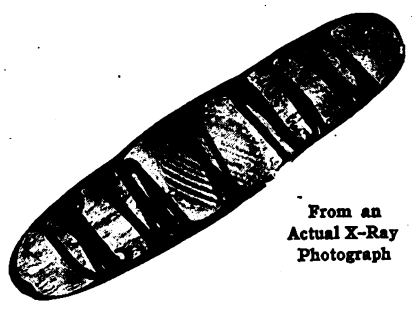
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(Reproduced from an Actual Flashlight Photograph)

CAPITAL
Industrial Brooms and Brushes

Prove Superiority in Service



From an Actual X-Ray Photograph

The photograph reproduced above shows the result of a severe competitive test conducted by a large railroad. The two CAPITAL "Red Cap" Metal-cased Brooms (at the right) were used with two ordinary "wire wound" brooms of similar weight under identical conditions. At the end of the test the "Red Cap" Brooms were still practically as good as new, while the wire-wound brooms were totally unfit for further service.

This X-Ray photograph explains why "Red Cap" Brooms retain their material until completely worn out. Forty-two wrought-iron nails, clinched under 10,000 pounds pressure, criss-cross through the broom head. Nailing is the best construction to insure a solid, long-wearing factory broom. Always specify "Red Cap" Brooms on the purchase order to your jobber.

"Red Cap" Brooms Cut Sweeping Costs

Capital "Red Cap" Metal-cased Brooms not only sweep easier and cleaner, but experience proves that ONE "RED CAP" ACTUALLY OUTWEARS TWO OR THREE ORDINARY BROOMS. *Figure that saving in your own sweeping costs!* "Red Cap" Brooms are better made to meet the extraordinary demand of industrial use. They are built in a wide metal case, nailed from each side with wrought iron nails, with an extra metal reinforcing band and two rows of heavy waxed twine. The materials are carefully selected corn and split bamboo, all-corn, or corn and soft, round rattan. THEY ARE GUARANTEED, SUBJECT TO RETURN FOR FULL CREDIT WITHIN 30 DAYS, CARRYING CHARGES BOTH WAYS PAID BY US.

Every Industry Can Use CAPITAL Brooms and Brushes

The CAPITAL Line meets practically every industrial requirement in mill and factory brooms, push brooms, floor brushes, bench and counter dusters, etc. Our Catalog No. 17 illustrates and describes the entire line and from it you can select the brooms or brushes that meet your particular need. Our jobber near you (who probably is your own hardware or mill supply jobber) will then fill your order promptly and completely, under the terms of our money-back guarantee. SEND FOR CATALOG 17. Start Now to cut sweeping costs.

Indianapolis Brush & Broom Mfg. Co.,
I. W. LEMAUX, *President*
34 Brush St., Indianapolis, Ind.

→ MAIL THIS COUPON ←

Indianapolis Brush & Broom Mfg. Co.,
130 Brush Street, Indianapolis, Ind.

Send us Catalog 17, and the name of your nearest jobber.

Name.....

Address.....

(Continued from page 44)

to install this pneumatic sweeping system in the rebuilding of the Chicago & Northwestern Grain Elevator in order that at all times the building may be kept free from accumulations of dust and in order that the sweeping process itself may not constitute an additional hazard. In other words, the ordinary process of sweeping by means of brushes and brooms always raises a considerable cloud of dust in the air, thus constituting a very undesirable hazard, whereas with the pneumatic sweeping system the dust is all sucked into the nozzle and the sweeping process can not possibly raise or scatter any dust whatever.

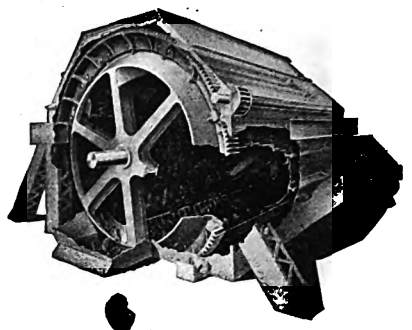
This pneumatic sweeping system in Chicago & Northwestern Grain Elevator is designed on the order of the ordinary stationary vacuum cleaner but is of such tremendously greater size and capacity that it is referred to as a pneumatic sweeping system rather than a vacuum cleaning system. In this connection it is interesting to note that this is the largest pneumatic sweeping system ever installed in any building, there being something over two miles of piping and more than six hundred hose connection inlet valves distributed throughout the building so that a length of hose can be attached and the dust collecting work carried on in any part of the edifice.

The accompanying photographs clearly show the damage done to the elevator when the explosion occurred, other photographs showing the pneumatic sweeping system in operation, the advantages being not only the safe and dustless removal of dust, but also constituting a more efficient and economical means of cleaning the building.

As the system collects from two to three carloads of dust per day, the dust separators were necessarily of a special design with a continuously operating discharge valve, by means of which the dust is discharged from the vacuum tank to the atmosphere without destroying the vacuum in the tank. When discharged from the separator the dust is dropped into a low pressure exhaust system which conveys it through a sheet metal duct

(Continued on page 48)

COAL
Preparation



"Pennsylvania" Bradford Breaker



WHAT DOES TRAMP IRON DO TO YOUR COAL HANDLING MACHINERY?

"Pennsylvania" Bradford Breakers and Hammer Crushers automatically and accurately pick out the tramp iron during the crushing operation, preventing damage to crushers, and stokers, without extra power or upkeep.

In addition, "Pennsylvania" Bradford Breakers automatically remove the harder impurities including slate, bone, rock sulphur balls and mine props, together with the tramp iron, while preparing Bituminous coal for Stokers, By-Product Coking, Gas Making and preliminary to pulverization for Powdered Fuel Plants.

We have brought the right solution to many coal preparation problems, and are ready to cooperate, on receipt of your suggestion.

Send for Bulletin 6001.

PENNSYLVANIA CRUSHER COMPANY

1320-1325 Stephen Girard Bldg.,
PHILADELPHIA, PA.

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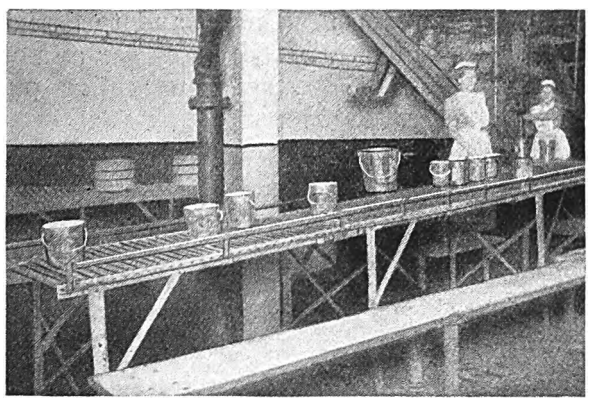
Safeguard Against Labor Shortage

THE labor situation makes it imperative to take steps immediately to prevent a serious curtailment of your output. Whether or not your business is listed as essential makes little difference. The present shortage can only grow more acute and make itself felt in every line of manufacture.

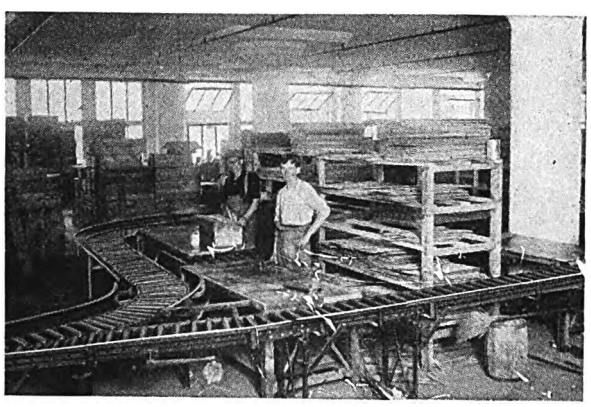
The first and most practical economy should be to eliminate hand conveying. This has become a form of labor wastage, for in the majority of cases, man power can be supplanted by the Mathews Gravity Roller Conveyer. Gravity conveying not only cuts down your payroll but it cuts out unnecessary delays, breakage costs and the unreliability of unskilled labor.



Bringing in the fresh fruit from the car or wagon



Gravity carries pails or boxes of cans equally well



Switches bring different products to a shipping point

Many of America's largest and most far-sighted manufacturers foresaw present conditions and realized the value of the Mathews Gravity Roller Conveyer in such an emergency. Their experiences have proved conclusively that it pays for itself many times over in labor saved. You too can raise the efficiency of your plant with the

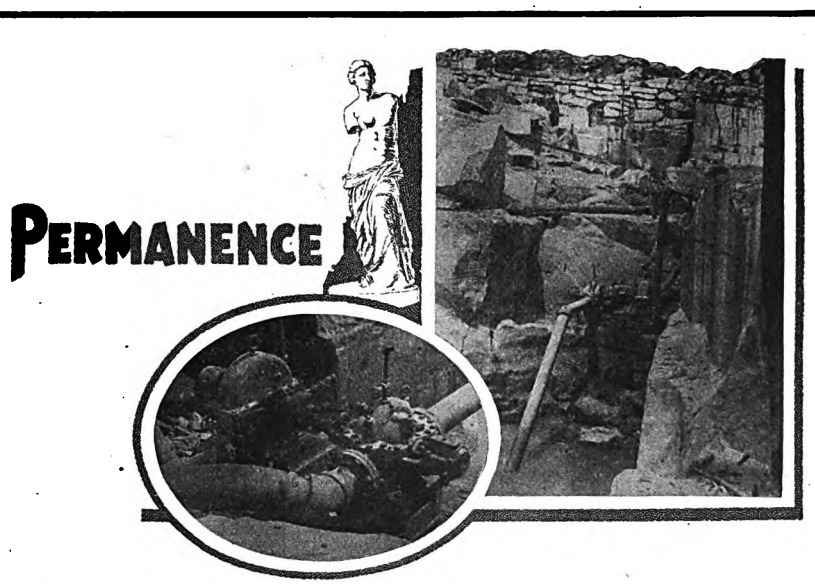
MATHEWS
SPEED ECONOMY
GRAVITY ROLLER CONVEYER

Gravity eliminates heavy conveying from the packing room and other departments. This condition enables you to replace men with women and makes you further independent of labor conditions.

The Mathews Gravity Carrier Company manufacture the most highly perfected gravity conveying system now on the market. The system is so complete in fact, that it can be adapted to the needs of practically any plant. We maintain a staff of engineers to solve conveying problems of unusual difficulty. Let us help you cut the cost of production and speed up work. Drop us a line.

MATHEWS GRAVITY CARRIER CO.
122 Tenth Street, Ellwood City, Pa.
Branch Factories: Toronto, Canada—London, England

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HERE is a Terry performing under difficulties. Installed in a marble quarry, exposed to the elements, clamped to irregular rocky surface without grouting, strained by unsupported pipes—but still it functions and drains the water from the quarry so that beautiful building material can be removed. It may be a long way from the statue of Venus to a Terry turbine, but though it was once stormed by the elements and buried in volcanic dust, Venus has been restored to us and still functions as a work of art. We can only surmise what beauty this statue might now possess had it received the protection such creations should have. But we know what Terry turbines will do under the care and protection of the modern power plant, for ninety-six of the first hundred Terrys which were made some twenty years ago are still in operation. Inbuilt permanence is a Terry feature which you should consider.

T-799

THE TERRY TURBINE

Offices in Principal Cities in U.S.A. also in Important Industrial Foreign Countries

The Terry Steam Turbine Co. Terry Sq. Hartford, Conn. U.S.A.

(*Continued from page 46*)

more than 1,000 feet away to the dust house which is located at some distance from the elevator proper.

The enormous air exhausting plant of the pneumatic sweeping system consists of four 25 horsepower units, connected in parallel. These units constantly maintain a high degree of vacuum throughout the entire piping system so that whenever an inlet valve is opened and a length of hose attached, there is a tremendous and powerful suction, so powerful indeed that the system is fully capable of removing iron nuts and washers although of course there is no occasion for it to remove anything but the dust which is being constantly precipitated in such tremendous quantities.

Converting the Airplane to Peace-Time Use

(*Continued from page 16*)

although it owes its greatest development to the needs of warfare, may be transferred directly to spheres of usefulness in the arts of peace.

When it is realized that the flying of heavier than air machines has been practiced successfully for less than twenty years (the first successful flight was made by Orville Wright, December 17, 1903) it is really little less than marvellous that in so short a time the science of aviation should have reached the stage of success that it has at present, particularly as it is really only within the last half-dozen years that it has advanced past the purely experimental stage. It is perhaps a sad commentary upon the state of our civilization that those engaged in working towards the perfection of the aeroplane should have received so little encouragement until the necessity arose for more efficacious machines for slaughtering men. On the other hand, as the incentive which the war gave to the development of aeronautics embodies one of the few instances where civilization has scored an advancement as a result of the war, it may be well perhaps to take the advantage offered without looking too closely into the sources from which it comes.

This is the course that is being followed by the Dominion of Canada. Before the war, aviation in Canada practically did not exist. It was a form of service, however, that attracted a great number of young Canadians to the British Imperial Air Services; and after the Armistice Canada found herself with a corps of trained airmen second to none in the world in point of experience and efficiency. These young men had been recruited from various walks of civil life and they could, of course, go back to their pre-war occupations, as many were quite glad to do. But there were others who, having once tasted the savor of flying through the air, were very reluctant to return to field, office or factory. So it was really not until after the war was over that the Canada Air Board came into existence. Its purpose was to utilize to as great a degree as possible the training and experience of this body of men for the uses of the future and to direct their activities as far as possible into the constructive purposes of peace.

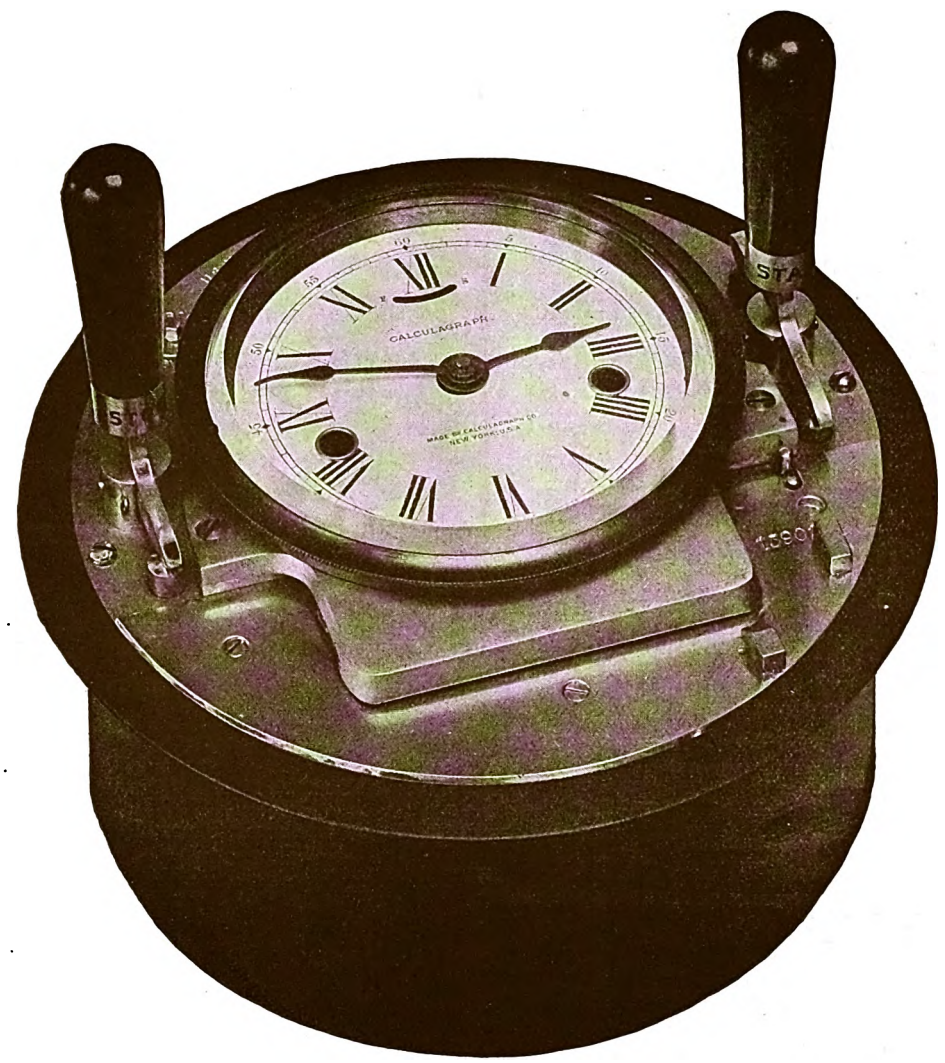
The functions of the Canada Air Board are threefold:

1. Control of Civil Aviation. This has to do with the examination and licensing of pilots; registration and inspection of aircraft; the surveying and charting of aerial highways and air harbors; and the enforcement of regulations laid down by law from time to time for the guidance and control of aerial navigation.

2. Civil Government Flying. This branch of the service is for the purpose of lending assistance to other government departments, such as Forestry, Mines, Fisheries, Customs, Agriculture, etc., wherever aircraft may be used to expedite the work of that particular department, or to reduce costs of operation. Seven Civil Government Flying Stations have been established throughout the Dominion: at Vancouver, B. C.; High River, Alberta;

(*Continued on page 51*)

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That man Jones in your factory is wasting your money

That man Jones, who operates one of the many machines in your factory, is keeping his own time on a slip of paper. In the same way all the Smiths and Browns and others in your factory are keeping their own time.

And every time that they set down the elapsed time on a job the odds are ten to one that their records are inaccurate. For Jones, and Smith, and Brown are human—just as liable to make an error as you are.

Why persist in letting your mechanics guess at the time each job takes? Why not install a machine that records the elapsed time by a simple pull on a lever?

The Calculagraph is a spring-driven machine free from the wiring troubles of electrical time recorders. It stamps the starting, stopping and ELAPSED TIME right on the job ticket.

It eliminates all errors on the part of the operator. He no longer guesses. The printed record is there as proof.

It saves the time of cost clerks. They no longer need to subtract starting from stopping time. The elapsed time can be read direct from the job ticket.

Any number of workmen can use one Calculagraph. A backward-forward movement of the right hand lever when the job starts, a pull on the left hand lever when the job is done, and the time record is complete.

Send for our booklet "Elapsed Time Records" today. It will interest you.

THE CALCULAGRAPH

THE ELAPSED TIME RECORDER

34 Church Street, New York City

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More Valuable Than Gold

THE subject of our cover for this month is a photograph taken 7,500 feet below the surface of the ground. It shows copper ore being dumped into a skip for hoisting to the surface, in the Calumet-Hecla copper mine at Calumet, Michigan.

We are accustomed to thinking that gold is the most valuable metal in the world, with the exception of platinum. These two metals, it is true, possess one characteristic which sets them apart from the commoner metals—their immunity to corrosion. Nevertheless, while gold is an accepted standard of value, the metal itself has contributed almost nothing to man's advancement. From a standpoint of usefulness, gold is handicapped by excessive weight, softness, low tensile strength, high electrical resistance, low heat conductivity. Even if we were to discover unlimited, easily workable deposits of gold, the effect would only be to throw the world's financial machinery out of gear.

If, on the other hand, we were to discover unlimited and easily workable deposits of copper, there is hardly a field of human endeavor that would not benefit. The telephone, the telegraph, and their younger brother, radio, all depend upon copper. Without copper, there could be no brass or bronze. Lacking copper, there would be no such things as electric lights and electric motors; we could not proceed with electrification of railroads and development of water power.

If gold failed us, the world would have to readjust its financial system on a basis of silver or platinum, perhaps—but if copper should fail, civilization must halt its onward march until some as yet unknown substitute could be found.

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GRAPHIC Charts show at a glance what it would take page after page of small type to explain. The use of Charts, therefore, is becoming more and more universal in modern business, as the best, quickest, most economical, and most easily understood way to present facts, visualize tendencies and show results.

But few of us, however, know how to make or use good charts. Hence the presentation of our facts is often confusing, misleading inaccurate, defeating the very purposes for which our reports have been drawn up.

Mr. Brinton's handbook is the most comprehensive and practically useful work on the subject of graphs ever written. Is not only shows how to make, use and read charts, maps, diagrams and plotted curves of every description, but also classifies all the serviceable methods of graphic presentation, pointing out the uses and defects of each.

Everywhere it is recognized as the standard. It is one book which should be at the elbow of every man who handles statistics of any sort, or who makes or receives reports—every man who wants to know accurately how things are going in his business—every man who wants others to know what he is doing or to see things in his way—the executive, the manager, the department head, the engineer, the statistician, the cost accountant, the sales manager, the public official, the lawyer.

To know how to insure your reports being read, your facts remembered, your figures understood, and your statements always accorded a hearty and interested welcome, let Brinton's handbook be your guide.

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(Continued from page 48)

Victoria Beach, Manitoba; Sioux Lookout, Ontario; Ottawa, Ontario; Roberval, Quebec; and Dartmouth, N. S.

3. Canadian Air Force. This is the military branch with its central training camp at Camp Borden, Ontario.

This article will deal with the second of the above classifications.

Perhaps the greatest field for the employment of aircraft is in connection with Canada's great forest areas. First of all, and of most importance, is the detection and fighting of forest fires. If great fires could be prevented from levying their annual toll upon the Dominion's forest areas the lumberman would probably have some difficulty in keeping pace with the yearly growth; but as it is, fire constitutes the greatest menace to the continued existence of the forest. During comparatively recent years an efficient system of fire supervision has been instituted by the Dominion Forestry Department, but Canada is a large country, the timbered areas being naturally in a great many cases far from settled neighborhoods, and fire rangers, having immense districts to supervise, quite often find difficulty in reaching the scene of a fire before it has gained such a start as to be almost beyond control—or at any rate, before a great deal of valuable timber is destroyed. Frequently the fire ranger, after discovering the fire and realizing he can do nothing unaided, has to travel long distances on foot, by canoe or on horseback before being able to reach the nearest telephone in order to summon assistance. With the aid of the aeroplane, or flying boat, however, it is possible to make regular patrols over the whole district at frequent intervals. When smoke is seen in any part of the area its origin can be investigated almost immediately. If the fire can be coped with by the fire-ranger with the assistance of the air pilot this is done; if it has gained too much headway, additional men can be rushed to the scene by aircraft.

The following excerpt from a report of the Dominion forestry supervisor for Manitoba after making an experimental flight of 1,000 miles by seaplane will give some idea of how aircraft appeals to a man whose previous efforts at fire detection and prevention have been conducted from a canoe. He says:

"From my observation I am thoroughly convinced that flying boats are very far ahead of our present method of patrols. We could always see from 30 to 50 miles on either side of the plane, and it would be no difficulty to locate smoke at this distance. When you compare this with a canoe traveling up a river with high banks, where it is impossible to see more than 100 yards in either direction, and where the patrol would be unable to notice smoke unless it were driven down over him, the advantage is entirely on the side of the plane. By reading the diaries of the fire rangers I find that in a great many instances, even though they see smoke, they spend days in locating the fire, and I am convinced that half of the fires which occur are never located or reported. On the other hand, the aeroplane is able to fly directly to the scene of the smoke, and land on a nearby lake. We have already proved this conclusively, as we have observed smoke, located the fire, taken men to the fire district and extinguished the fire in five cases east of Lake Winnipeg. * * * I am thoroughly convinced that patrol with canoes is obsolete, and also convinced that it will be possible to do the work more efficiently with aircraft and at considerably less cost than our present methods."

The wanton destruction of the forests of North America during the past century is a standing reproach. Governments and individuals alike are now coming to a realization of the fact that only by large-scale reforestation can the forest heritage of the past be transmitted to future generations. Reforestation, however, requires a knowledge of the forests, their area, the density and condition of the timber thereon, and many other particulars. It is estimated that such a survey of Canada's forests would take almost half a century by using the methods of the past. In the first place, in former days, it was necessary to reach the particular area to be surveyed. This was



"If you ever have a *real* business problem, send for him"

"YOU KNOW there are some problems which a man can't take to his partners or even his personal friends."

The speaker was an officer of a growing company in a middle western city. It was the lunch hour; he and a business associate were on their way to the Club.

"I had such a situation in my own experience a year ago," he continued. "I don't need to go into the details except to say that the decision would make a lot of difference not only to me, but in the whole policy of our concern.

"One afternoon in my office I was trying to think the thing thru. What I wanted was someone I knew well enough to trust, but who didn't know me *so* well that he would let personal considerations influence his judgment. I was just about stumped when my secretary brought in a card. I recognized the name of the local representative of the Alexander Hamilton Institute."

The speaker paused and pointed to a man across the street.

"There he is, going into that building," he said. "Seeing him reminded me of the story.

"Well, his call struck me as a sort of inspiration. I said to myself, 'Here's a chap who has probably talked over more different kinds of business problems than almost anyone else in town. He's trustworthy, he goes in and out of all sorts of offices and he knows how to respect a confidence.'

"To make a long story short I had him sit down and listen while I laid all the cards on the table. We were together for more than an hour, and he made the most direct and intelligent suggestions you can imagine. He had nothing to gain directly from this but he could not have been of any greater help if he had been doing it for a large fee. If you ever have a *real* business problem I'd advise you to send for him."

One of these representatives lives permanently in your locality. He is meeting ten men a day on an average, sixty men a week, three thousand in a year. They talk to him with surprising intimacy about their business problems and future, *not* because he is inherently wiser than they, but because the confidences of so many men have given him an unparallelled wealth of experience.

He may come to you some day with a card from one of your friends. The purpose of his call will be to explain the Institute's Modern Business Course and Service but you will find him ready and anxious to give you the best he has in the way of friendly co-operation and sincere advice. It is his business to put before you the facts regarding the Institute's method of providing sound business knowledge by means of its Course and Service. His personal success depends on his ability to help the men on whom he calls. Consequently, we should like to have you feel that his call is a service call in the fullest sense of the word. The Alexander Hamilton Institute was founded *for service* to business men.

You will be interested in learning how much its service includes as explained in the little book, "Forging Ahead in Business," published for distribution to men at the top, and men who are on their way. A copy of it will go forward to you with our compliments if you will fill in the coupon and return it to us.

Alexander Hamilton Institute
689 Astor Place, New York City

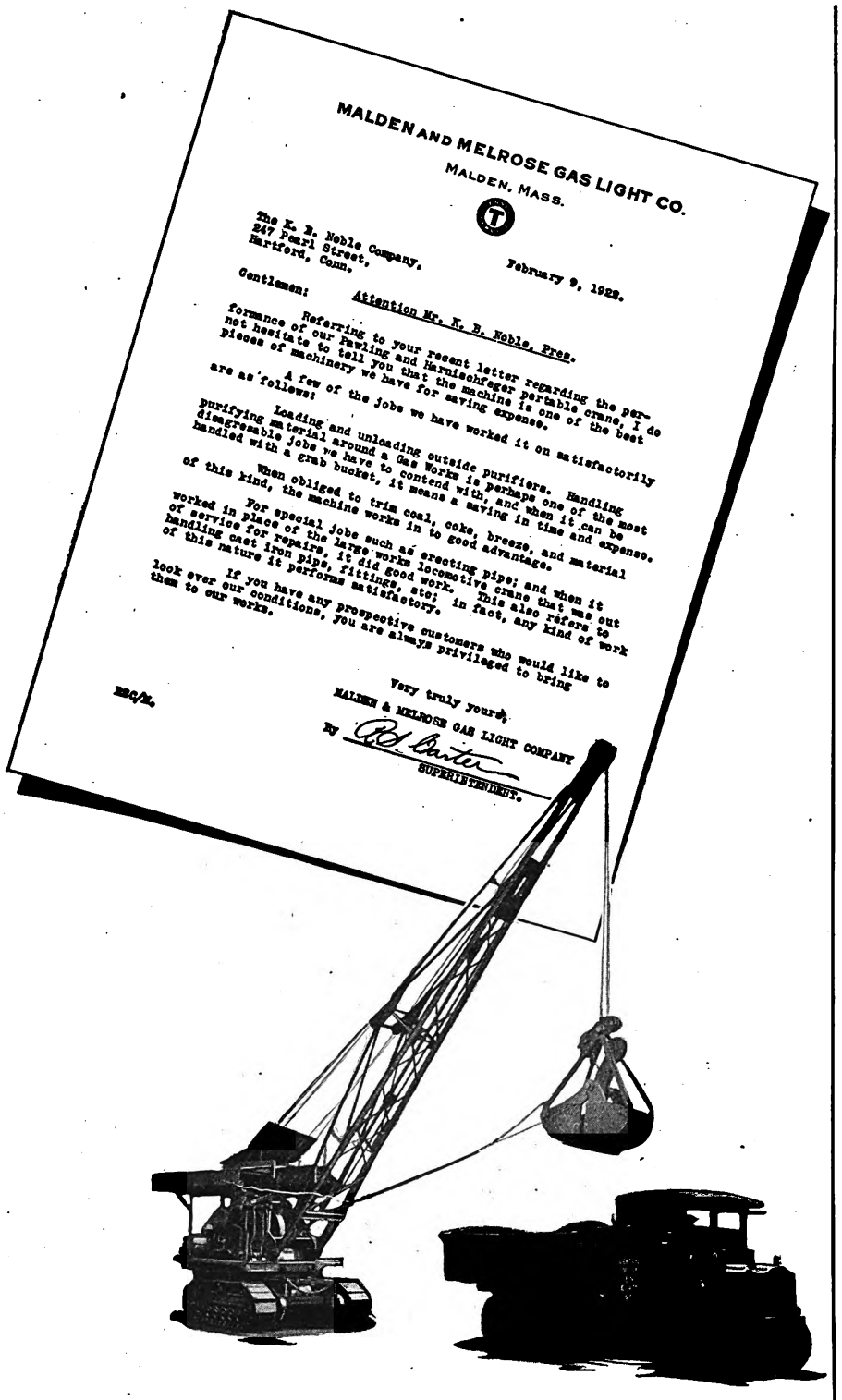
Send me "Forging Ahead in Business" which I may keep without obligation.

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Canadian Address, C.P.R. Building, Toronto; Australian Address, 42 Hunter St., Sydney

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done by means of canoes or packhorses, depending upon where the timber was situated. Then the tract must be thoroughly cruised on foot, a number of measured areas containing an average growth marked off, the number of trees counted in each, the diameters and heights measured or estimated and the whole recorded so that the total amount of timber upon that particular tract might be estimated as closely as possible.

By means of aircraft, however, the cruiser can travel as far in an hour as he previously did sometimes in a week. Once arrived at the particular tract it is possible to fly above the timber and make a thorough examination of it. Also, if necessary, a series of photographs may be taken and a mosaic made of the whole area. This can be supplemented by a number of "close-ups" taken from a distance of just a few hundred feet above the treetops showing every tree in detail. Armed with these, and the data secured during the flights, the aerial timber cruiser can complete his estimates in the comparative comfort of his office.

A further use has been found for aircraft in connection with the forest areas in assisting the work of studying and combating various forms of tree-destroying insects. Next to fire, perhaps the greatest enemies the forests have are insects. The Canadian government maintains an efficient staff of entomologists, but here again the vastness of the country's timberlands and the great distances to be traversed would require an enormous staff of men to make even an attempt to deal effectively with these pests; but with aircraft the story is different. The entomologist can examine the forests from above, locating the points where insects have been at work; these are marked upon the map and remedial efforts concentrated upon the places most needing them.

One would hardly imagine that the airplane could be of any use in fighting the nimble mosquito, yet the following extract from a report of a Dominion government entomologist in charge of mosquito investigations shows how it is done. He says:

"For years there have been demands for an investigation into the mosquito pest of the Fraser Valley, B. C. During bad seasons all outdoor activities have been seriously affected, lumber camps have been obliged to close down, small fruit picking has been hampered, and great material loss has been incurred through the drop in milk production in the dairy sections. Cases are even on record where cattle have actually succumbed through attacks of mosquitoes.

"In 1919 the entomological branch commenced an investigation embracing the 2,000 square miles of affected territory, and it was found that the nuisance had its origin in the low-lying areas adjacent to the Fraser River, and subject to flooding at times of high freshet. It was found that serious outbreaks never occurred at flood levels under 17 feet 6 inches, but where the flood level exceeded 18 feet 6 inches a serious scourge almost invariably resulted. For two years efforts were made by local surveys (by auto, on foot, and by boat) to locate and define the position and extent of the various breeding areas (which often ran to many thousand acres). It was found impossible to obtain sufficient data over such an extensive territory, and the value of aerial surveys in this connection presented itself. The results obtained during the present season [1921] have justified our expectations, and I am of the opinion that this is the most feasible method of covering such an extensive territory, where detailed maps are not available. * * *

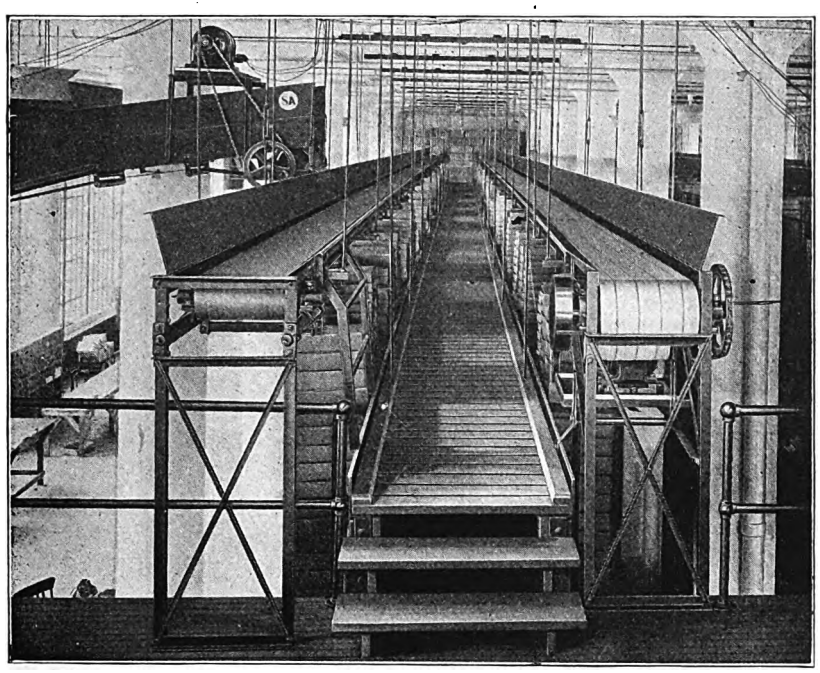
"The field notes obtained during the flights, together with the photographs, have enabled us to obtain a comprehensive idea of the Fraser Valley situation, and have placed us in a position to make concrete recommendations dealing with the control of the pest."

During the season of 1921 seaplanes from the Vancouver station of the Canada Air Board were used to assist the geodetic survey in locating suitable triangulation points in the mountainous section of British Columbia. In this way the surveyors were enabled to

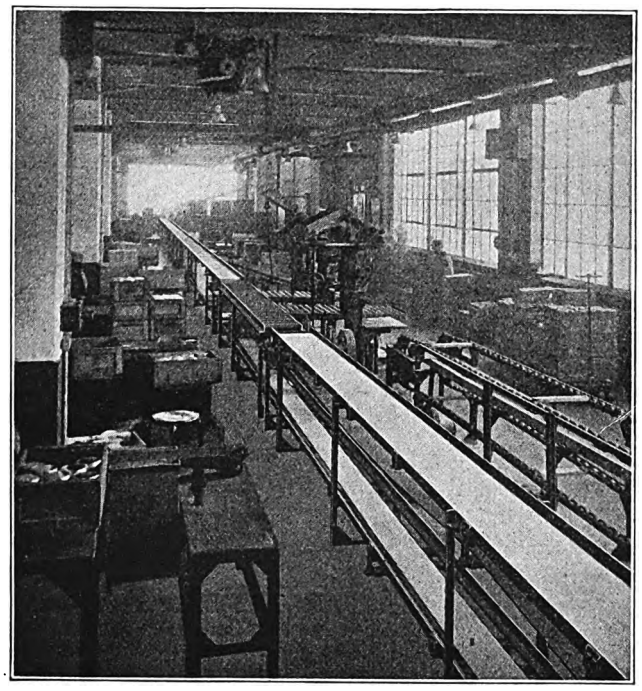
(*Continued on page 54*)

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it will surprise you to know what it has actually cost you to handle your materials in the past year. To get just an idea of the money which is being wasted through lax methods of handling materials in your plant go into each department starting in the receiving and finishing in the shipping. Make notations of the methods used, amount of time consumed to carry articles to and from given points and draw your own conclusions as to why your handling costs are high.

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WHERE molten metal runs and splashes like milk—where the fierybroth shifts its flame-tints through violet, orange, pink, white and blue as it is "seasoned" with carbon, ferro-manganese, tungsten, ferosilicon or vanadium—the practice in years gone by was to gauge the proper pouring temperature by overseeing the colors with the naked eye. The expert peered into the maw of that inferno, protected by colored glasses, and when he judged the time was ripe—out leaped the frenzied stream into the incandescent ladles! The result might or might not be good steel, of the proper grade for the purpose intended.

But today nothing is left to chance. Nothing is left to the sense of sight unaided, to guesswork or the human element. No. Today the accuracy of Tycos Pyrometers and other Tycos Temperature Indicating and Recording Instruments furnishes that vital "sixth sense" which enables workmen to know exactly the temperature of the furnace even though it mount higher than 3,600 degrees F—and to control it absolutely, some by the radiation of heat rays, some by direct current.



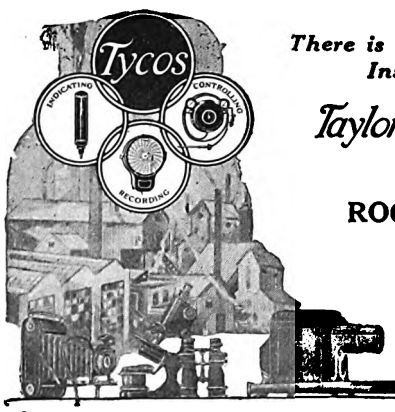
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And for every process involving such heat control and heat treatment thereis a type and style of instrument in the Tycos line, embracing as it does over 8,000 types and styles.

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What is your problem of applying this "sixth sense" to your plant? What do you make? Write us and literature on any instrument or type of instrument will be sent you promptly. Tycos experts are ready to advise on its application to your plant.



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Tycos Temperature Instruments

INDICATING · RECORDING · CONTROLLING

(*Continued from page 52*)

select the most suitable mountan peaks by examining the topography of the country from the air. The engineer in charge has stated that by the use of aircraft fully three years' time was saved in addition to the elimination of a great deal of painful and laborious work which would otherwise have had to be done on foot. In addition aircraft were also employed in assisting members of the geological survey, particularly in Northern Ontario. Large areas of the country are of granite formation and others are covered with heavy glacial deposit. By the use of aircraft the geologist can eliminate these areas in advance and therefore devote his time to a more detailed examination of more promising territory, thus saving much time and effort.

Seaplanes have also been used in connection with the reconnaissance of flooded areas for reclamation work in Manitoba. The hydraulic engineer in charge of the Carrot River reclamation scheme in that province reports in part as follows:

"I cannot speak too highly of the benefits derived from a flight of this kind in connection with survey work on a project of the magnitude of the proposed Carrot River Triangle Drainage Project, involving as it does an area from 800,000 to 900,000 acres, a large part of which is practically inaccessible in the summer season on account of the flooded condition of the interior. Much of this district is unsurveyed and very little information of the topographicad features of this section is obtainable without running a traverse survey. From the air you can see the various drainage channels in the interior quite distinctly, and information of this kind would prove of great value in determining to a large extent where it would be necessary to run our interior traverse lines and where lines would not be necessary, thereby saving time and money."

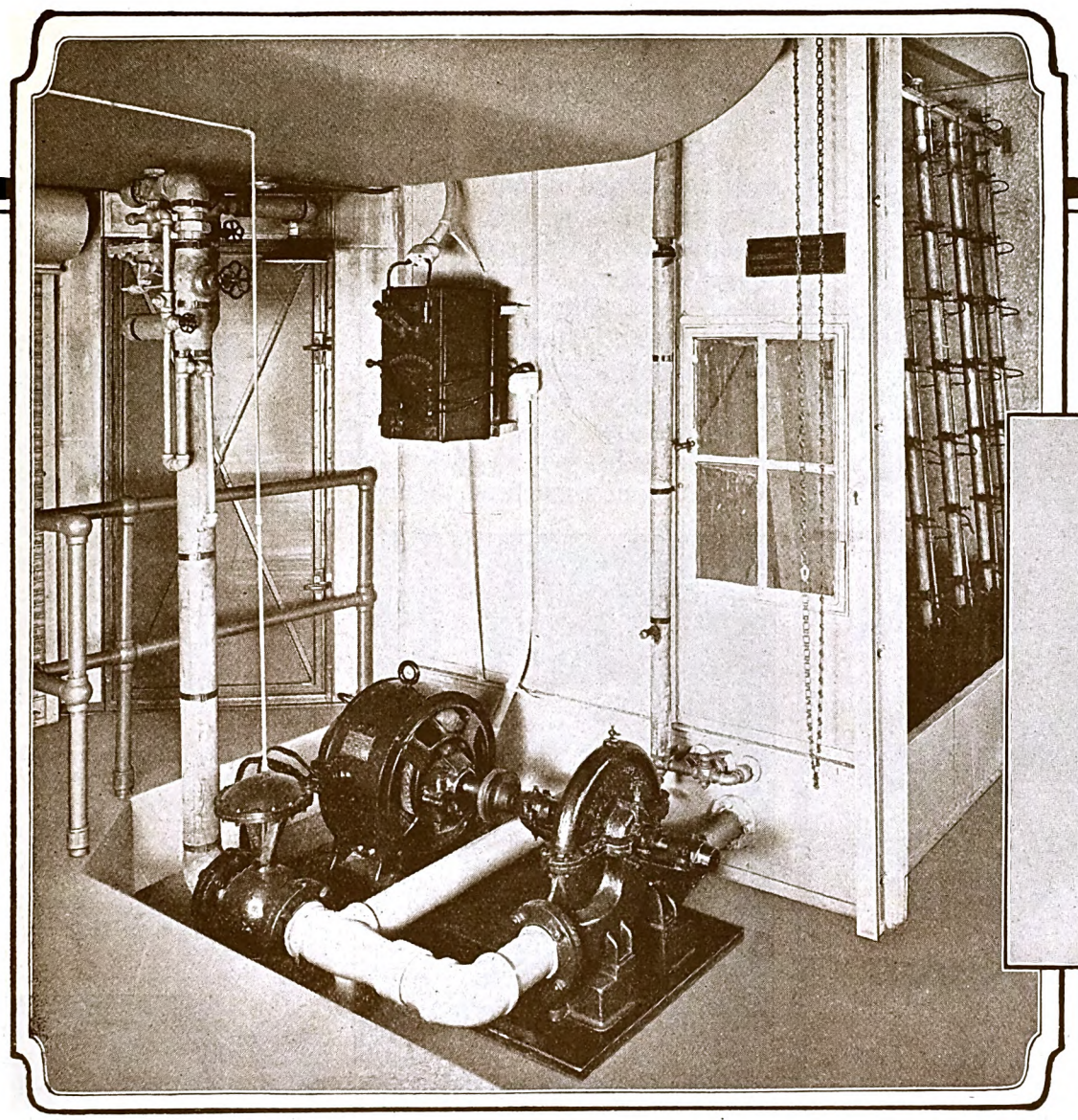
Another field of usefulness for aircraft has been found in the detection and apprehension of smugglers. There has always been a considerable amount of smuggling taking place through the port of Vancouver, particularly as regards illicit drugs as they are capable of being done up in such small packages and are of such great relative value. One method of smuggling consists in the smuggler throwing the packages containing the drugs overboard just before the ship comes into the harbor. The spot is marked, and the smuggler subsequently returns with a small boat or launch and picks up his valuable flotsam. But now the trans-Pacific lines are met some considerable distance out of port by seaplanes containing revenue officers. They escort the ship into her dock circling round and round her the while. In this manner attempts to throw drugs or other smuggled articles into the sea are frustrated; and in a number of cases smugglers have been caught in the act and apprehended.

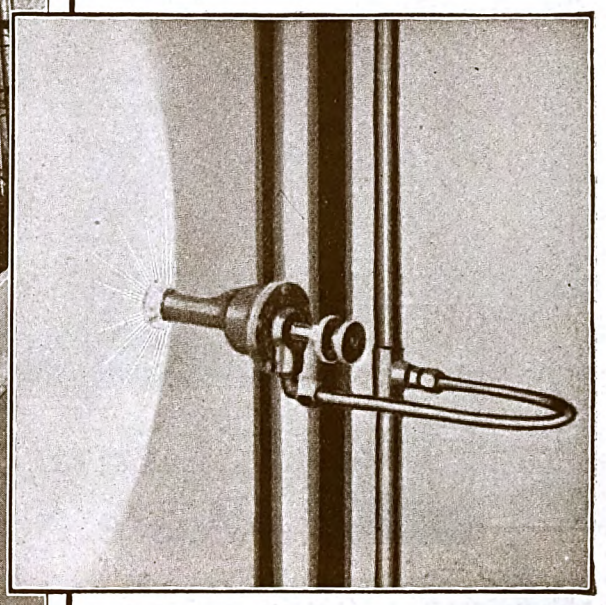
Seaplanes have been found useful, too, in connection with the enforcement of regulations concerning closed seasons for fishing. In a more direct manner they have been of value to the fishermen by indicating the presence of schools of fish which might otherwise have been allowed to pass without leaving their toll within the nets of the fishermen.

These are by no means the only uses which have been found for aircraft by the civil government flying department, and more are being discovered as experiments are conducted in other fields. While these activities are all confined to the uses of government departments, the mere fact that the value of aircraft in these various connections is being demonstrated by the Air Board in this way cannot fail to assist in the development of flying as a commercial proposition. The Air Board is always careful not to enter into competition with private individuals who wish to undertake any phase of commercial aviation, but rather is willing and anxious to assist private fliers in every way.

There is little doubt that the eventual establishment of commercial aviation upon a stable basis, at least in Canada, will be due in no small measure to the efforts, past, present and projected, of the civil government flying department of the Canada Air Board.

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The above illustration shows the wide spread of the blanket of mist as it comes from the spray nozzle.

The air washer is shown to the right in the larger illustration.

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It's because of the special design of the spray nozzles of the American Blower Air Washer that the impurities are removed from the air passing through this air purifying system.

These spray nozzles produce a heavy blanket of mist so finely divided as to literally form a dense cloud through which every atom of air must pass, causing it to be cooled, humidified and purified.

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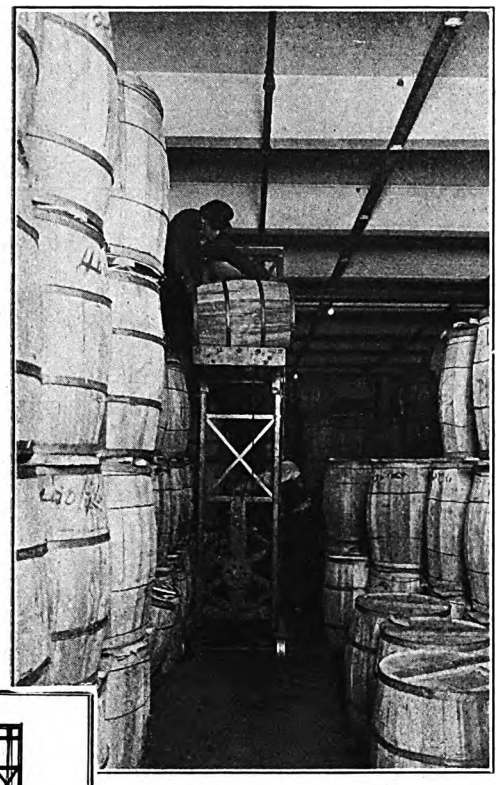
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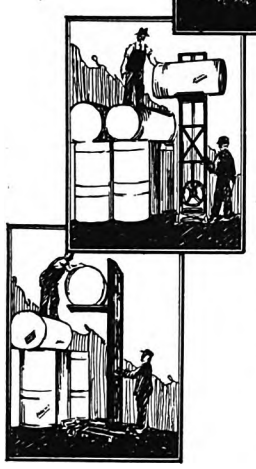
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Ability to lower on hoisting spindle as well as quick speed

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For the first time hitherto wasted space can be turned into good storage room at very little cost.

Send for booklet describing this remarkable portable elevator.

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Three Simple Operations

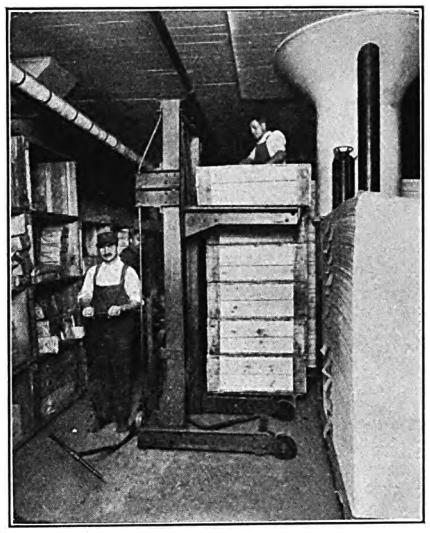
1. Package loaded directly on elevator platform.
2. Raises load to top or any desired height.
3. Placed in position on pile.

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90 West Street, New York City

What's in a Name?

(*Continued from page 25*)

equipment and I am sure if they will look at their tiering machines as portable elevators they will increase their usefulness. It is possible by slight alterations to make the standard makes of machines fit numerous places and it will be found cheaper to do this than it would be to design and build an entirely new machine. Some



of the Tiering Machine manufacturers are already inferring that their tiering machines are really portable elevators; but it is hard for them to change the name, the same as it is hard for a fond mother to get over calling a six foot man "Sweetie." Look at the equipment and the photographs and determine for yourself which name applies and describes the uses for the equipment best—Tiering Machine or Portable Elevator?

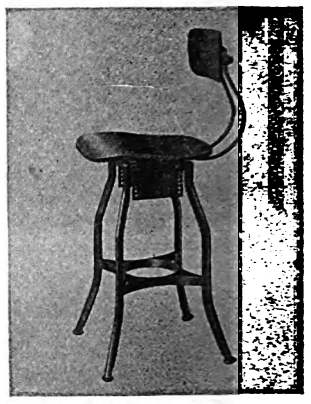
Washington, D. C. — The slate industry, an important source of roofing, blackboards, billiard-table tops, and other more or less essential products, labors under a staggering handicap of waste, states the Bureau of Mines, which has completed a study of the subject.

Slate makes such durable and attractive roofing that its use should be greatly encouraged, the Bureau of Mines considers furthermore, its noninflammability as compared with wood adds to its value, for the most frequent cause of dwelling-house fires in the United States is said to be sparks from a chimney alighting on a wood-shingle roof.

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for some workers in a Boston publisher's bindery. Fatigue is decreased by the perfect adjustment possible with this chair to the individual seating condition.

This chair supports the body where support is needed and eliminates preventable fatigue.



The PosturChair is designed to fit the seated body. It encourages good posture and makes it the comfortable position. It has been designed by experts in seating. It is approved by a nationally known health organization—the American Posture League, and each chair bears its label.

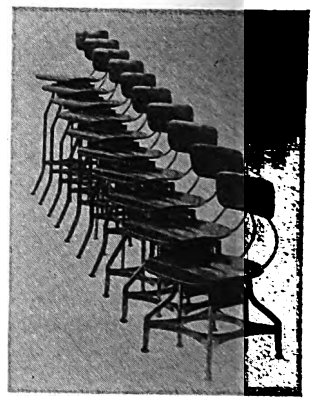
It is a piece of production machinery and as such is being adopted by large employers of labor everywhere.

There is only one right way to sit. The seated skeleton tells the story.



Special Features: Made of cold rolled steel except seat and back support which are of wood. 10 heights, each with 3" height adjustment. Seat tilts forward or backward. Back support, swivel and adjustable in height. Durably constructed, neatly finished.

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Manufacturers of steel equipment for factories, stores, offices and schools.

TRY ONE AT OUR RISK

If you are seeking more production and greater health protection for your workers, write us for a sample to try under your own conditions. It's free for two weeks use. Mention height needed. Descriptive pamphlets available.

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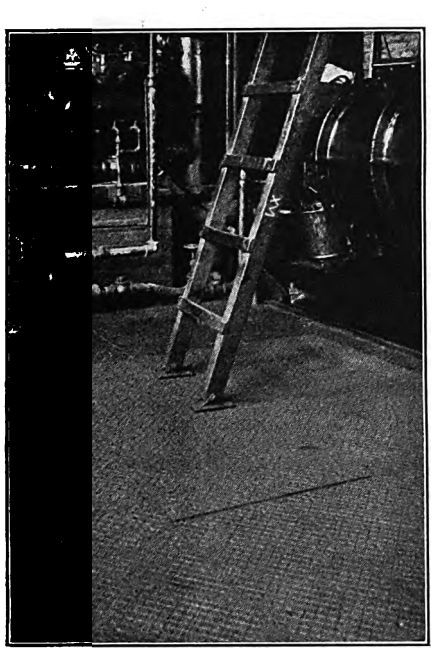
Modern Factory Floors and Their Maintenance

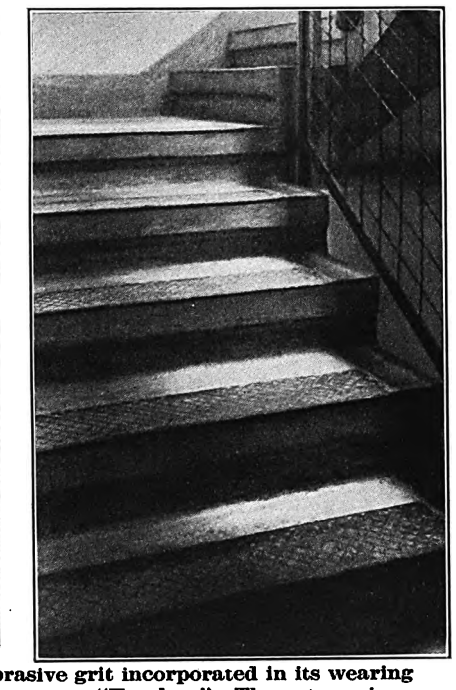
(*Continued from page 21*)

the other as these things always do.

But concrete is not a comfortable floor when one has to stand upon it for long periods. Thus research and ingenuity began to look about for preparations or materials that would provide the flexibility, heat insulation, damp-proofness and comfort of the old wooden floor, while still retaining the rigid durability of concrete. The answer in a good many cases has been in the nature of compromise with concrete as a sub-floor or foundation, and with wood planking, wood block, bituminous sheet or other tread surface. So today the factory manager has a wide choice of admirable materials that will provide comfort as well as strength, and at stand aghast at the cost of the modern factory floor. But if he were educated, to regard his floor as an investment in daily transportation, his views would rapidly change. Cost is high or low depending on what you get for it.

The old style factory floor had but two principal requirements. It had to be level enough to make it possible to pile things upon it, and it had to be strong enough to keep workmen and work from falling through it. The modern factory floor, on the contrary, has a long list of requirements which of course vary in individual importance with the conditions that are encountered. It must be rigid and free from vibration, damp and dust proof, an insulator for heat (for coal costs money), it must





A combination of iron plate, with abrasive grit incorporated in its wearing surface at the time of casting, is known as "Feralun." These two views show it in two different applications.

the same time present an exceedingly attractive and neat appearance. Our first three illustrations, for example, show applications of the same make of flooring to widely different purposes in office and production departments. The power plant and factory department of today is entitled in the estimation of the modern factory manager to as much if not more consideration in the matter of floors than is his office.

Naturally, this policy costs money. An old style factory manager or shop man would be long lived under severe usage, able to carry heavy loads concentrated upon truck wheels, it must resist abrasion, it must be comfortable to the workers' feet; resilient. In some cases it must be acid-proof and have high dielectric qualities. And it must be of such a nature that a part of it can be renewed when required, without renewing the entire surface.

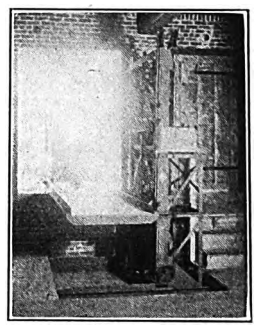
Block floors composed of wood or asphalt are found in a large number of factory de-

(*Continued on page 59*)



Economy System of Storage Handling

PROFIT FROM EVERY INCH OF SPACE



Making up a difference in floor levels at the Hygrade Lamp Company's plant.

In every industry millions of dollars are wasted annually in unused space and excess labor.

Your own plant may be no exception and probably contains unutilized space which could show a profit instead of a loss.

The Economy Barrel Storage Racks installed in one of the warehouses of the Associated Oil Company of California (note illustration above), and the Economy Electric Portable Elevator shows how this company has made use of space formerly unused instead of building additional warehouses.

The advantages the photograph illustrates are:

1. Labor is saved.
2. Storage capacity increased
3. All grades of oil made readily accessible.
4. Leakage, where barrels are used, is prevented by the weight being taken off lower tiers.
5. Order, cleanliness and safety promoted.

Write for a copy of "SAVING WASTED MILLIONS." In it you will find many suggestions and illustrations of Economy Storage Handling System. It does not obligate you in any way and will open up to you a new way to reduce handling costs, save labor and utilize wasted space.

ECONOMY ENGINEERING CO.

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HAVE YOU A FLOOR WHICH IS BADLY WORN?

One of the qualities of Marbleloid *permanent* Flooring is that it can be used for re-surfacing old worn-out wood and concrete floors.

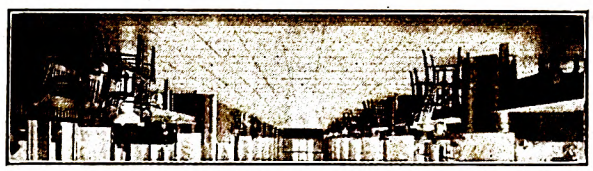
This composition flooring is laid plastic over the old floor and in a few hours you have a strong, warm, smooth-surfaced, modern floor which adds much to the appearance, serviceability and permanence of your building. This Marbleloid Floor will not dust or chip, will be found certain and elastic for walking and will not require any expensive upkeep. It will also prove non-abrasive, a quality most desired in industrial buildings where machinery is installed.

MARBLELOID
The Universal FLOORING for Modern Buildings

We install each Marbleloid Floor as well as manufacture the material and we will *guarantee it* to please you in attractiveness, longevity, warmth, strength and in all other qualities we claim for it.

If you have a worn floor in your building let our engineers tell you the cost of transforming it into a modern, fireproof and durable Marbleloid Floor—or if you are erecting a a new building be sure to investigate the suitability of Marbleloid for its floors.

Use coupon below if you want an advisory estimate or copy of our 32 page floor book.



The Marbleloid Co., 467 8th Ave., New York

THE MARBLELOID COMPANY, New York City: Without obligating myself in any way, please submit tentative estimates on the cost of your product installed complete for our building.....
.....; below are the approximate areas involved.
Floor.....Sq. Ft. Sanitary Base.....Lineal Ft.
Wainscot.....Sq. Ft. I have checked the floor troubles we now have.

Our floors are
[ ] New Concrete [ ] Cement Finish [ ] Wood
[ ] Cracking [ ] Cold [ ] Slippery
[ ] Dusting [ ] Splintering [ ] Unsanitary
[ ] Noisy [ ] Rough [ ] Rotting

Name .....
Firm .....
Address.....
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OWNERS OF PILING MACHINES
REGARDLESS OF TYPE

OUR model "K" attachment can be applied to your hand operated portable elevator, no matter what type it is. It adds another service to your machine and does not interfere with the hand operation. Can be run from ordinary lighting circuit. It makes the machine run faster and is instantly available for use in any place. Indoors where electric current is handy, just plug into lighting circuit and let the motor do the work. Outdoors, or at any place where power is not available, use the hand crank. No adjustments, no changes—motor or hand power at the will of the operator. We are prepared to convert hand machines of any type into combination hand and motor, without delay.
The Revolvator shown in the cut above is a combination machine—hand or motor operated—with a revolvable base.
Write for bulletin E64—today.

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311 Garfield Ave., Jersey City, N. J.

Just Suppose--

You had coming to you every month a big bunch of Pictured Progress such as you see in this copy of

INDUSTRY ILLUSTRATED

Wouldn't you give it a hearty welcome?

Wouldn't it put a dash and a sparkle into the daily grind you have always wanted—but which you have found hard to get?

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(*Continued from page 57*)

partments. The success of the *wood block* as a street-paving material has no doubt been responsible for this development. The success of any wood block floor depends upon the rigidity of the individual blocks. If these remain tightly and firmly in position they will wear indefinitely. If they become loose under wear and tear they will disintegrate rapidly. It is also very essential that they be uniformly supported; usually they are installed on a concrete base and bedded in bituminous material. Bituminous filler is also poured between the intersticies.

The manufacturer of *asphalt blocks* from crushed stone and Trinidad asphalt has steadily increased until it has become a national industry. These blocks are pressed into form in powerful mechanical presses. Asphalt blocks are in extensive use for street paving and are now coming into general use as a shop floor. Such a floor is fireproof, comparatively noiseless and, being made of a trap rock composition, always presents a gritty non-slippery surface. It is adaptable to many kinds of foundation, preferably concrete with a thin mortar bed between the concrete and the asphalt blocks. For an absolutely waterproof construction, layers of asphalted felt may be placed between the sub-floor and the mortar bed.

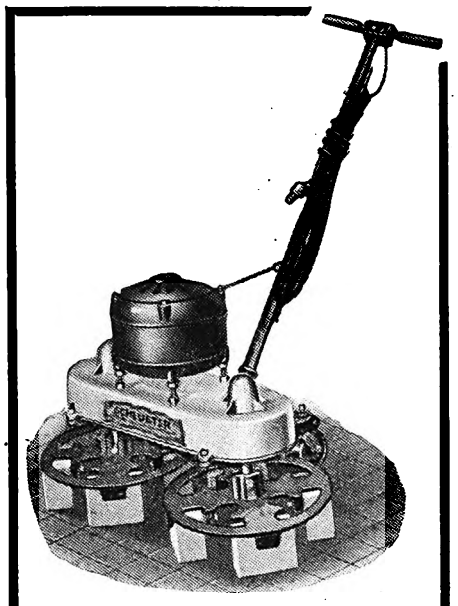
Monolithic plastic floors have reached a high state of perfection. They are laid in a plastic condition and hardened or set into seamless tough bodies which offer neither joints nor crevices for the accumulation of germs or moisture. Prominent among such floors are those based on *magnesite* and known to the building trade under the term of composition flooring. Such material adheres firmly to wood, concrete or iron and may be installed over old flooring as well as upon new construction. The formula of the composition of these floors varies according to the service required. One advantage of using a magnesite base is in the possibility of securing almost any color or finish desired. This feature is appreciated in offices, show rooms and power plants perhaps more than in the production department of the factory.

Monolithic floors made up of an *asphalt base* are also common. Such flooring is made of a mixture of Trinidad Lake asphalt and mineral filler and is trowelled while hot over any type of old flooring to a thickness of one and a half to two inches. When the composition cools and is ready for use it presents a resilient, durable water and acid proof monolithic sheet without cracks or crevices.

An interesting development of recent years is that of *fibre flooring* which is produced as a by-product by one of the largest American shoe manufacturers. The origin of this flooring was in the large quantities of waste material resulting from the operation of tanneries and shoe factories. As a result of this, after several years' experience and test, leather fibre is now produced and on the market rolled into sheets and ready to lay over a suitable foundation. Some of the desirable features which are claimed for this flooring are noiselessness, resiliency,



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FLOOR FINISHING MACHINES

These improved Schlueter Machines will really make your floors show up on the profit side of the ledger. They pay for themselves in the cost of labor they replace, and the amount of time they save. They are very simple to operate; they need no special operator. A trial will convince you of their advantages.

ABOVE The machine pictured above is for use on all kinds of stone floors or for sand papering floors of wood, cork or composition. Can be used for *scrubbing*, or *polishing*, or any kind of treatment. The discs are directly connected to the vertical driving shaft and revolve in opposite directions. No spot on the floor is missed.

The principal parts of the machine are covered so that there is no possible chance for grit or water to come in contact with motor, sprockets, gears, ball bearings, etc.

In operation it is very easy to guide, and as it is self-controlling it gives the operator time to treat the floor.

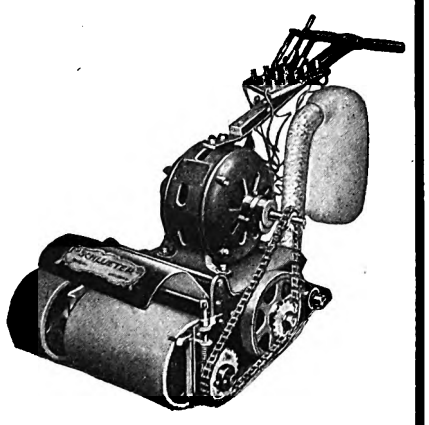
BELOW This machine gives a perfectly smooth finish to wood and cork floors. It is so constructed that it will surface close up to baseboard or wall without use of EDGE ROLLER.

The special feature of our machines is that they do not require the use of levers; the machine moves forward automatically when the operator raises the handle.

Thousands of these machines are in use all over the country. Perfect results are guaranteed. We assume all responsibility.

Send for our prices and free trial proposition.

M. L. SCHLUETER
235 West Illinois Street, Chicago



non inflammability and non-conductive qualities. It is said to resist wear to the extent that the feet of sharp shod horses make no impression on it.

Concrete, as has been said before, is as good a material as one can find for the average sub-floor or foundation. In many cases, particularly where workers do not have to stand upon it, concrete properly surfaced and hardened is quite suitable for the tread surface. It must be properly protected, however, for no matter how well laid, if left unprotected, it will eventually crumble and gradually wear down. On this point we quote an extract from the *Maintenance Engineer* for November-December, 1921, published by the Truscon Laboratories.

"A complaint often lodged against concrete floors is the fact that they dust and sand —that they are hard to keep clean. The more sweeping done, the more dusting.

"This cement dust, being very fine and abrasive, sifts and filters into everything, and is especially destructive when it becomes lodged into moving parts of machinery. In time this dust may become serious in its consequences to the floor, resulting in such a weakening of the wearing surface as to cause crumbling, and the formation of holes and ruts.

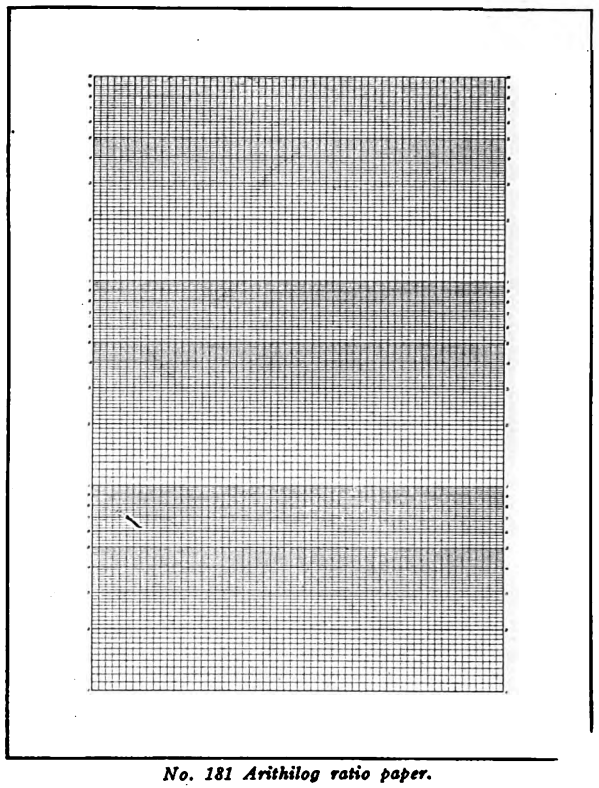
"The baffling part of this process of sanding and disintegration is that all floors do not wear alike—that given conditions of equal and of the same kind of wear, there will be a big variation in the way two floors may stand up in comparison. Two floors, having been laid by the same contractor at practically the same time, using the same material, with all other conditions apparently being equal, may be of such divergent character that one floor, subjected to very hard wear, might give better service than another subjected to relatively light wear.

"While cement requires relativly but a very small amount of water for its actual hydration, in practice a very large amount of water must be used in order to obtain its proper consistency for the processes of pouring, placing, tempering, etc. This quantity of water is variable, depending on the

(*Continued on page 62*)

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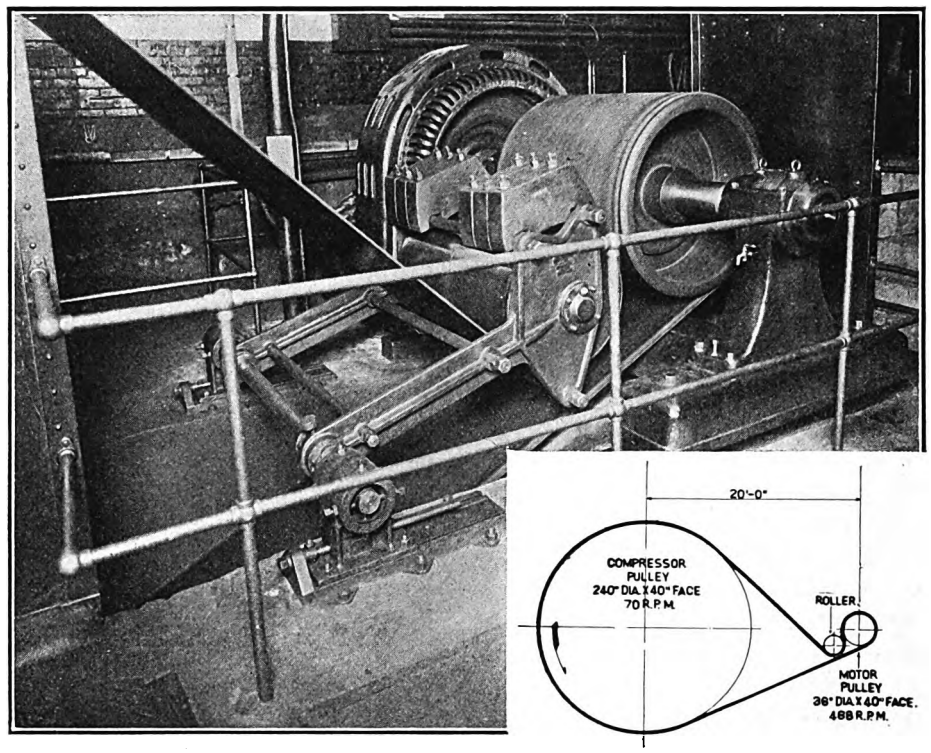
Containing instruction pamphlets and charting paper to experiment with:

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500 H.P. Motor Driven Compressor
Motor Pulley, 36" dia., 40" face, 468 R.P.M.
Compressor Pulley, 240" dia., 40" face, 70 R.P.M.
Double Leather Belt, 39" wide, 7/16" thick

The Electric Drive—and the LENIX

In changing a mill over from mechanical to electric drive there are usually several places where the LENIX will produce far better results than an ordinary belt drive.

In some cases it is practically the only type of drive that can be used. This is due to the fact that the LENIX permits the motor to be placed in any position in any plane without the least sacrifice to the efficiency of the drive.

But in all cases, by permitting short centers between motor pulley and driven pulley the LENIX saves valuable floor space. At the same time by "wrapping" the belt around the pulley (see illustration) a greater arc of contact is secured. More power is delivered. Belt slippage is practically eliminated.

There are more than 3,000 LENIX drives in operation in this country. There would be some in *your* mill if you were familiar with the advantages of this drive. You can get the facts by writing for a copy of "Saving Slippage and Space."

Five Points

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains, constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

F. L. SMIDTH & COMPANY
ENGINEERS
50 Church Street, New York

The LENIX Drive

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THE SEAT OF
Production



No. FS-22 Patented Adjustable Legs and Back-Rest.

In the nation's foremost manufacturing institutions, "Royal-Chicago" Seating is not only increasing production daily, but also the quality of the work and the loyalty of the workers.

Being scientifically designed to eliminate unnecessary fatigue, no amount of welfare work can possibly equal the practical results this seating has.

If you are not using "Royal-Chicago" chairs and stools now, it will pay you to investigate.

Royal Metal Mfg. Co.

MAKERS OF

"Royal-Chicago" PRODUCTS

The Correct Industrial Seating

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Chicago, Ill.



FS-15 Patented Adjustable

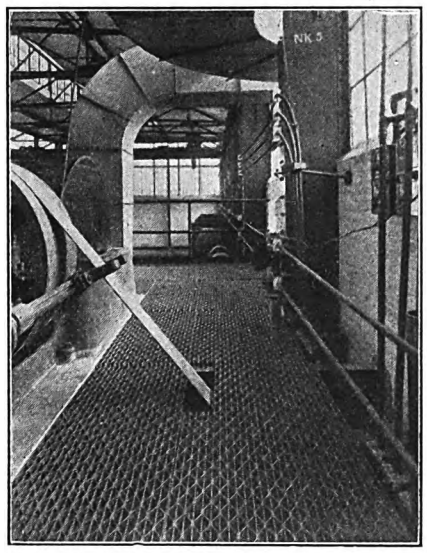
FS-14 Patented Adjustable

(*Continued from page 60*)

cement and other aggregates and atmospheric conditions.

"Where the skill and knowledge of the contractor's foreman comes in, however, is that although a large amount of water is necessary, an excess of water in a concrete floor is not desirable. Excess water makes the topping "sloppy," bringing the lighter particles, known as "laitance" to the surface. This "laitance" has very little binding or adhesive quality. It is one of the chief causes of the dusting of cement floors. Such a floor will dust even before it is worn; it may set so soft that the surface can be scratched off with the toe of the shoe.

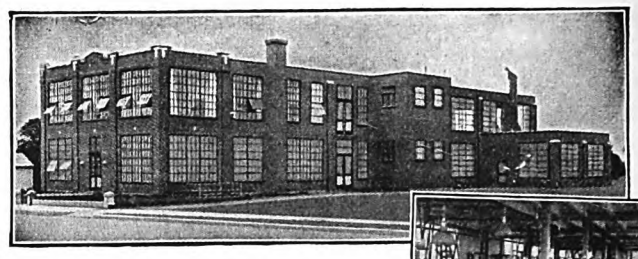
"Contrariwise, if too much water is not good for concrete or cement—then too little water is just as bad, because in that event the material has not the required fluidity to amalgamate the numerous particles into a compact mass —causing a weak bond.



For mezzanine and gallery floors, steel gratings are ideal, enabling easy access to all machinery, combined with safe footing and visibility.

"Again, the trowelling of cement is very important. The final trowelling should be done at just about the time of the initial set. This initial set may be any time from ¾ of an hour to 16 hours after the topping has been placed, depending entirely on cement and atmospheric conditions. A finish trowelled too soon will bring water and laitance to the surface, causing a dusty floor. If trowelled too late, it simply results in breaking down that crystalline structure which constitutes the initial set of the cement. If too much trowelling is done, we have again the appearance of lait-

(*Continued on page 65*)





The Royerford Needle Works

erected in 47 days including entire mechanical equipment and installation of machinery.

—INTERIOR—

Your New Building

IT can represent every modern improvement and yet be built in 30 to 90 days at a big saving, if you use Beling-Bush standardized Buildings. Using our method, you save because of centralized responsibility and on cost of plans and specifications. Write for booklet and information, and let us estimate.

Minimum Cost *Maximum Service*

The BELING~BUSH CO., INC.
FACTORY ENGINEERS AND BUILDERS
Drexel Building Philadelphia Pa.

"INSPECTION AND REGISTRATION OF STEAM BOILERS"

In fact, adoption of the A. S. M. E. code, etc., will benefit both manufacturer and user.

Another recommendation—one that we wish to make for the benefit of all users—is that the feed water level should be kept constantly at the proper point by the use of the Vigilant Feed Water Regulator. This will prevent coal from being wasted unnecessarily.

Our recommendation will tie in excellently with the movement now on foot.

This regulator is an absolute safeguard against explosions because low water is impossible with the Vigilant. There are no complicated parts to get out of order. And it cannot fail because it depends on gravity for its action.

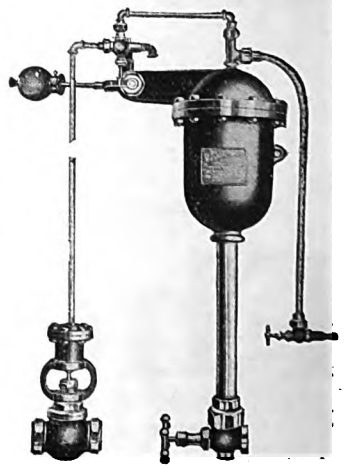
Instead of putting your trust in the human element, install the Vigilant Feed Water Regulator. If only for the protection it affords, the Vigilant pays big dividends.

Write for the calalog today

The Chaplin Fulton Mfg. Co.
28-36 Penn Avenue
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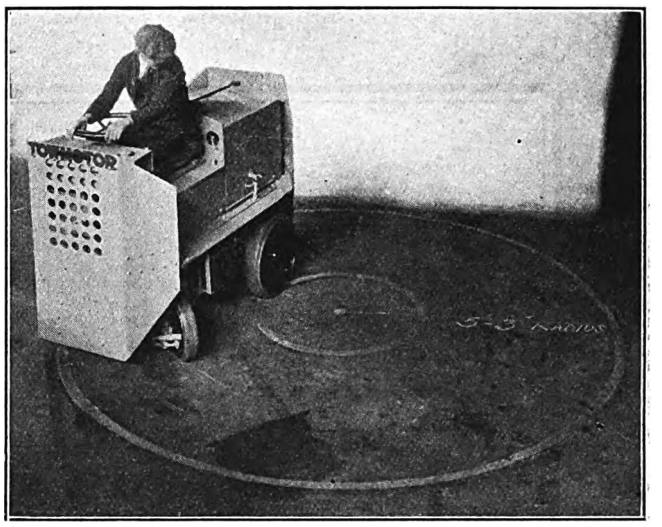
Sounds Good To Us

VIGILANT
Feed Water
Regulator



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Every Day, In Every Way, Increasing Orders Show That



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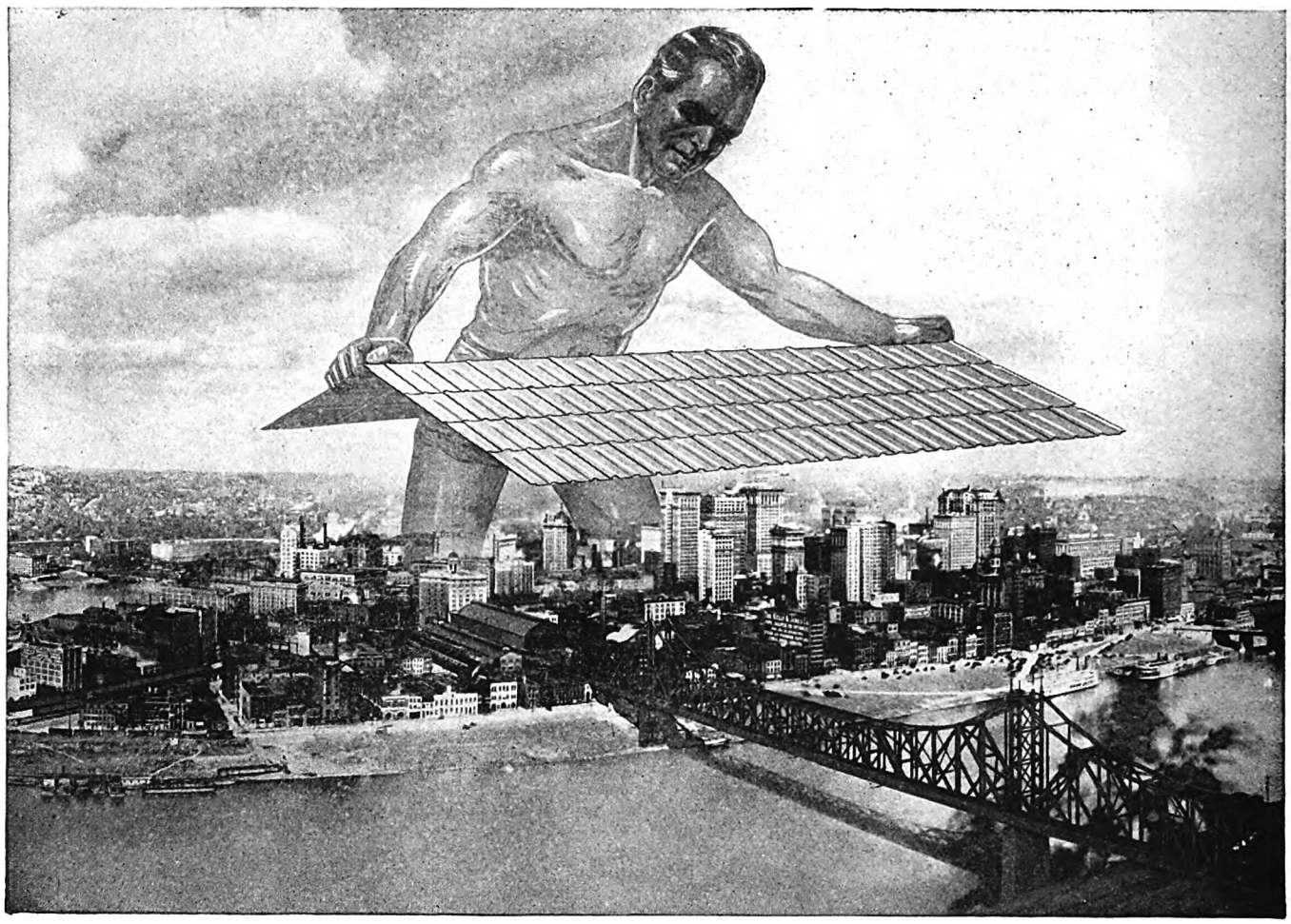


Are Justifying Their High Reputation For Quality, Economy And Service

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THE TOWMOTOR

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In Dollars and SENSE—

You can estimate the economy of a Bonanza "Cementile" Roof in dollars and *sense*. For example—

You erect a fireproof building and expect it to last throughout your lifetime—perhaps forty years—and figure that it should remain standing another forty or eighty in all.

Assume your roof has an initial cost of $1200. With an ordinary roof there will be repairs due in one to three years, and an entire reroofing after eight years at the most. If Bonanza "Cementile" is used the one roof will be practically permanent; will, under ordinary circumstances, outlast the building itself, and there will be no expense for repairs.

40 ÷ 8 = 5. Multiply 5 by $1200 and you have $6000, plus the cost of repairs. A Bonanza "Cementile" Roof may cost a trifle more initially, although ease of laying generally brings the cost close to that of the ordinary roof. Let us place its cost at $1500. In other words $1500 against $6000, or a saving of 400%—during your lifetime!—and this does not take care of the repair bill inevitable with an ordinary roof!

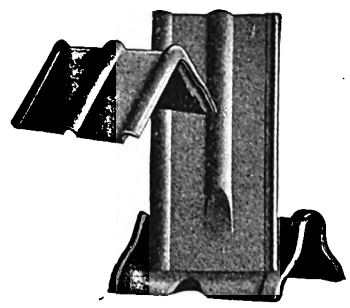
Which will you choose?

Our Catalog and Data Sheets will interest you; send for them today.

American Cement Tile Manufacturing Co.
831 Oliver Building, Pittsburgh, Pa.
PLANTS: Wampum, Pa. Lincoln, N. J. · Birmingham, Ala.
OFFICES: Pittsburgh · New York · Philadelphia · Cleveland · Birmingham

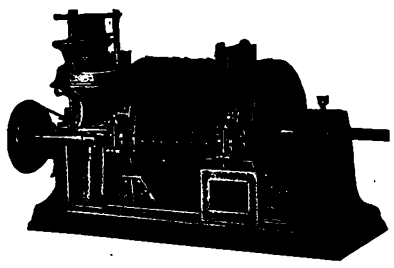
Bonanza "Cementile" is a reinforced cement tile roofing, with a pleasing outer surface, laid directly on the roof purlins. It is light, but very strong in structure, and absolutely fireproof and waterproof. Made for flat or pitched roofs, new or old.

The first cost of a Bonanza "Cementile" Roof is the last cost. We make and lay the roof, and unqualifiedly guarantee the material and labor.



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Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY

165 Broadway New York

(*Continued from page 62*)

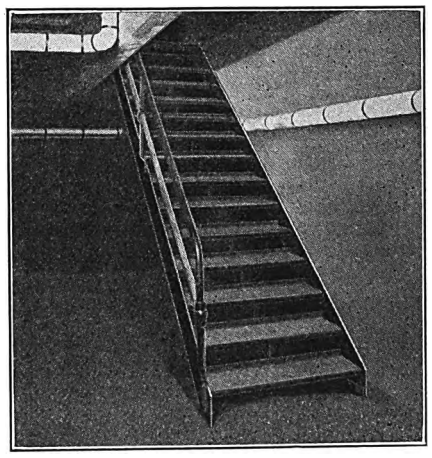
ance, due to water bringing only the lighter particles to the surface.

"Freezing, of course, is bound to cause damage and result in a soft, scaling floor, if not a defective structure. Such a floor may be a menace.

"The function of the sand and stone in concrete is to give compressive strength and wearing surface—the cement acting as the binder for holding the particles of sand and stone together. Naturally, if there is a lack of cement or a poor grade of cement, such conditions will result in a soft, crumbling floor. Again, if the sand is too fine or loamy, one will obtain a surface that is unable to bear up under the shock and abrasion of traffic.

"To recapitulate, we might list the probable reasons for soft, dusting cement floors, as follows:

Lack of cement
Poor cement
Poor sand (loamy—not sufficiently "sharp" or well graded)
Improper proportions cement and aggregate
Too much water
Not enough water
Drying too quickly (as in a steam-heated building, or exposed to direct sun's rays. All concrete and cement surfaces should be kept moist while hardening. This is very important.)



A factory stairway is usually a factory "hazard." Oil soaked slippery stairs cause many accidents. On these stairs, the treads and risers are of one piece rolled steel construction known as "Firmtread."

Troweling too soon
Troweling too late
Troweling too long
Freezing
Using floor too soon (before surface has had time to harden and set thoroughly, which process requires from a week to three

MULLER ASBESTONE GUARANTEED PRODUCTS TRADE MARK

THE IDEAL Factory and Office Flooring





Wood While beautiful in appearance when first laid, wood soon wears out and must be replaced. In addition, it is inflammable, unsanitary and NOT cheap.

Concrete. The cheapest of all flooring, concrete is unsatisfactory because of its non-resiliency. It is very tiring to workers and furthermore is subject to "dusting."



ASBESTONE

This composition flooring is hygienic, fireproof, resilient and easy to the tread, this latter quality adding materially to the efficiency of workers. It costs only slightly more than wood and is much more durable. ASBESTONE can be installed over either old or new wood or concrete under-floors by cement finishers, or if desired, we are prepared to submit prices for completed installations made by our expert mechanics.

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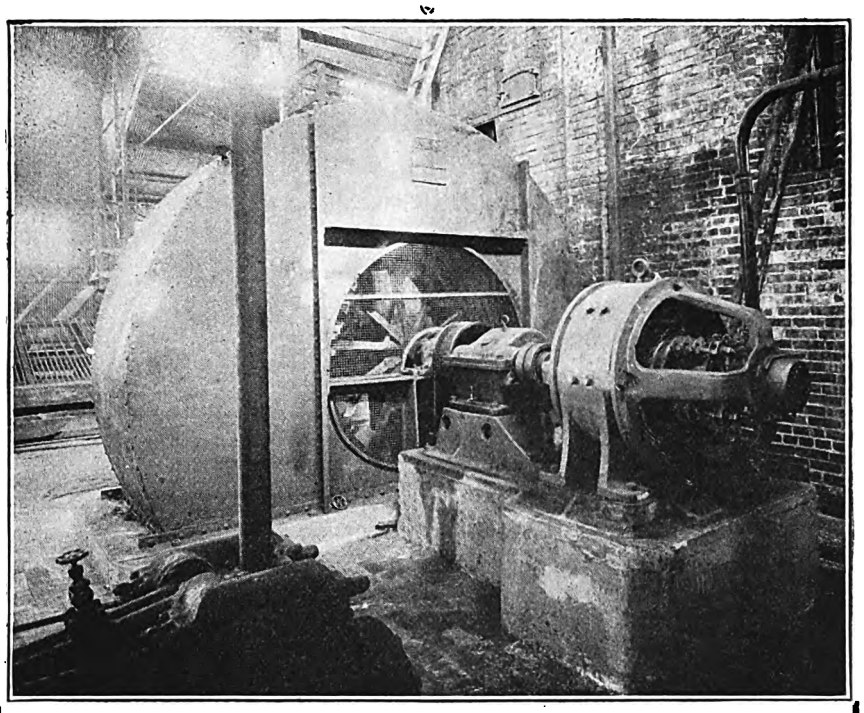
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ASBESTONE

The best medium priced interior flooring known by modern science.

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Better fans—better men

WHAT steam is to an engine, air is to a man.

A steam engine with half enough steam—impossible!

A man with half enough air—common!

Without considering the humanitarian side, viewed merely from a standpoint of dollars and cents, a high priced man deprived of good air and good ventilation is, like an under supplied engine, a bad investment.

Clarage Blower Systems keep your whole plant at just the right temperature during the coldest or the hottest days. Clarage systems cover every requirement—can be used for ventilating alone, or for heating and ventilating as well as humidifying. Regardless of the type or size of installation there is no deviation from the essential of good working conditions—a generous supply of air from out doors, uniformly supplied to every part of the mill, shop or factory.

Clarage engineers will place before you an unsurpassed accumulation of data covering ventilating systems of every type involving fan equipment. The scope of Clarage equipment is forcibly brought out by the booklet shown below. It covers the use of Clarage-Kalamazoo Systems for pneumatic conveying, for eliminating dust, dirt and fumes, for mechanical draft, as well as for ventilating, humidifying and air conditioning.



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Clarage Fan Co., Kalamazoo, Mich.

New York City, Charlotte, N. C., Minneapolis, Cleveland, Pittsburgh, Detroit, Los Angeles, Philadelphia, Chicago, Indianapolis, Rochester, N. Y.

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CLARAGE KALAMAZOO FANS AND BLOWERS

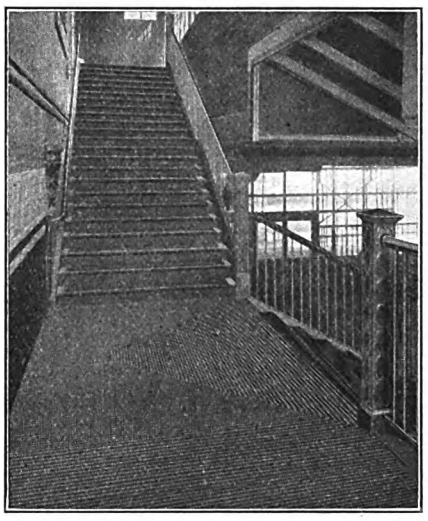
weeks, depending on local conditions

"Any one, or any combination of these conditions may cause unusually soft, dusting floors.

"Having sketched briefly what might be considered the major reasons for the dusting and gradual breaking down of the surface of a cement floor, we will now take up in detail the various methods which have been successfully applied and are recommended for putting a cement floor in such shape as to reduce its dusting to a hardly perceptible minimum, at the same time enabling it to give real wear and service, even under the hardest traffic. Practice today recommends one of three methods for protecting cement floor surfaces, as follows:

1. Hardening chemically.
2. Hardening mechanically.
3. Surface film treatments.

"The first two of these methods perform the function of dust-proofing and crumble-proofing a cement floor through actual intrinsic hardening of the surface. The third calls for the application of a protective coating or film over the floor, such as varnish, enamel or the like."



Stair and platform surfaces should be considered in connection with factory floors. Those shown above are covered with carborundum filled rolled steel plates, known as "Mason Safety Treads."

Concrete as a floor foundation does not by any means stand alone or unchallenged in the field of modern building activities. A sub-floor known as *coal tar concrete* and embodying a base of coal tar has been in use for the past forty years. These sub-floors may be laid directly over earth and require no stringers or air spaces. They make fireproof construction possible with wooden floors by excluding all

(*Continued on page 68*)



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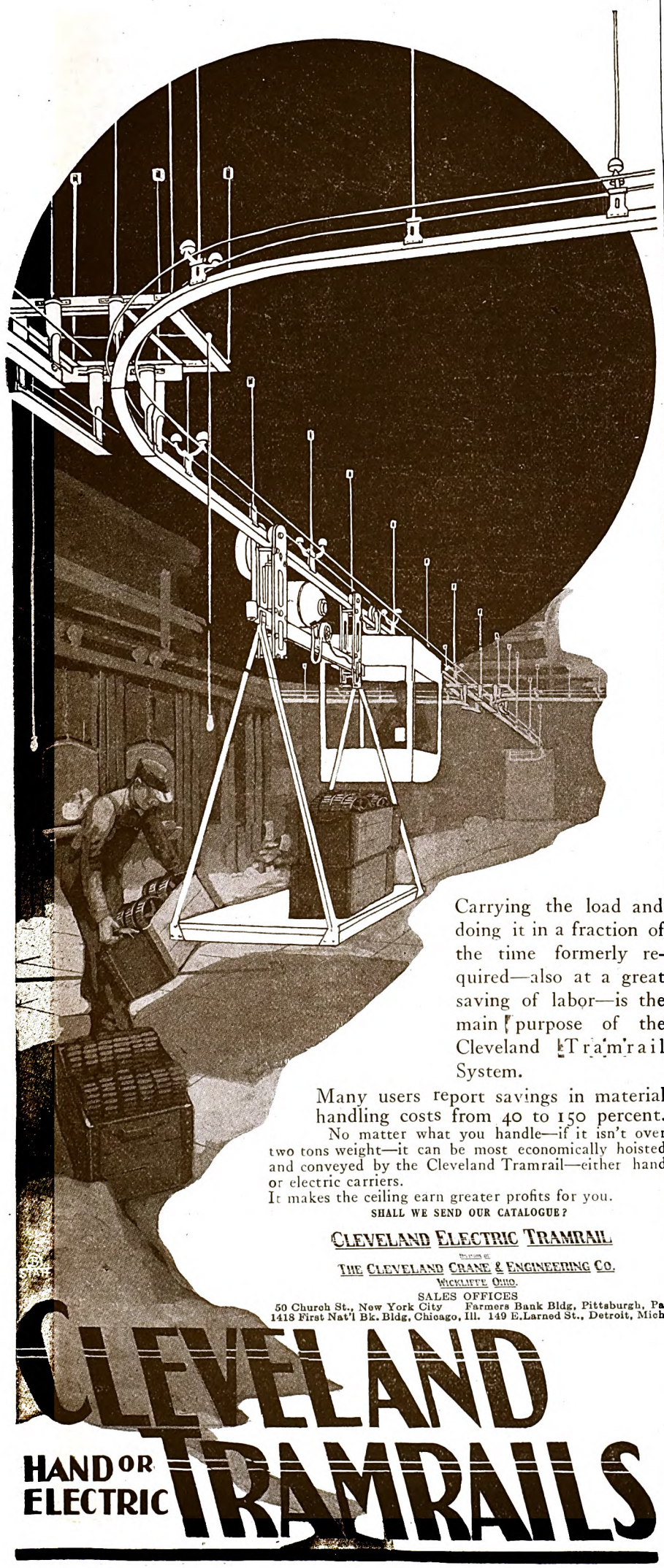
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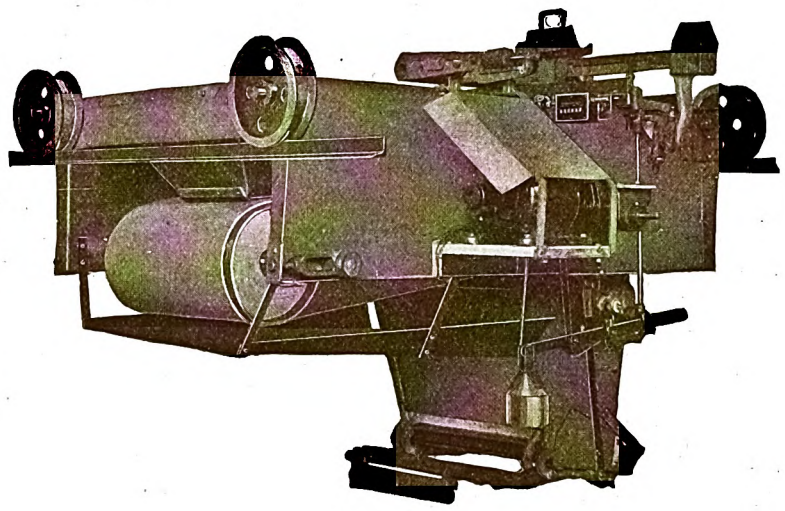
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Soot, scale, holes in fire, faulty boiler linings, etc., all tend to lower boiler efficiency. Incomplete combustion results, and coal that might be transformed into heat units is lost up the stack or down the ash pits.

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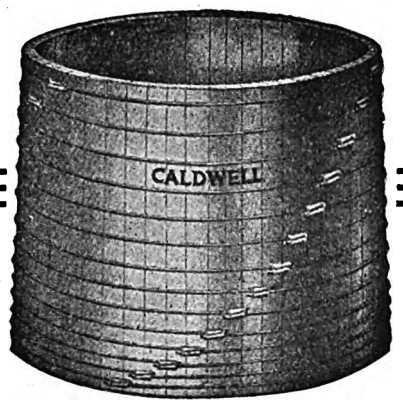
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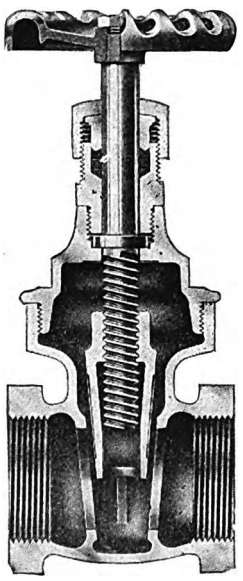


Fig. 370, Sectional View of Jenkins Standard Brass Gate Valve.

ACTUAL service has proved the Jenkins globe shaped body the best in gate valve design. This shape permits a thorough, even distribution of metal and insures valves that resist, without distortion and leakage, the severe stresses of working pressure and expansion and contraction of piping.

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Jenkins Valves
SINCE 1864

(*Continued from page 66*)

air from below. When laid upon earth the modern subfloor of this composition is laid in two courses, namely; foundation and damp proofing. The foundation course consists of some four inches of screened gravel or crushed stone between two and a half and one-quarter inches in size. This is mixed with tar of a proper consistency and compacted under a roller after being spread evenly in place. In cold weather the stones are slightly warmed to secure proper adherence. The damp proof course, which surmounts the foundation course, consists of a fine sand thoroughly mixed with the proper grade of tar in the proportion of not less than fifty gallons of tar to the cubic yard of sand. This mixture is spread evenly from one and a quarter to one and a half inches thick, compacted to one inch and leveled with a straight edge. Plank is laid directly over this damp proof course and hardwood flooring transversely across the plank. Frequently the ground is sufficiently firm so that a three-inch or even a two-inch foundation course is all that is required. Sub-floors of this type are also readily laid upon concrete slabs.

Steel flooring and cast iron has also come into the factory to fill an urgent need. Abrasive materials, for example, are incorporated at the time of casting into iron plates, so that the grit projects slightly above the metal; "the bite" thus secured makes slipping impossible. Such surfaces are extremely useful for stair treads, fire door saddles, elevator thresholds or hazardous places where slipping may produce serious injury.

Then there are rolled steel plates with anti-slipping qualities built into them by the raising of the diamond pattern in their surfaces or with the incorporation of a lead filling charged with carborundum. The use of such treads naturally depends upon the character of the factory equipment. Where floors are oily around machinery, such treads should be installed, as oil does not affect their non-slipping qualities.

Steel flooring is largely used for mezzanines and overhead galleries but must nevertheless be considered as coming under the head of factory floors. The modern paper mill or chemical or process plant finds considerable application for this light, clean and readily installed platform material which performs its function without shutting off the light or casting dense shadows on objects below.

A large volume could easily be written without exhausting the subject of modern factory floors. Unfortunately there is actually very little that has been printed on this subject. Let us hope that this brief resumé of modern developments will stimulate an adequate interest in this important source of manufacturing profits.

Fitting the Small Steam Turbine into the Factory

(*Continued from page 11*)

not influenced by the change of season.

The boiler plants necessary to do this heating are determined, in many instances, not by the amount of power, but by the volume of heat. In such cases the quantity of coal burned will be just as much, regardless of where the power comes from.

In magnitude the heat to be provided, in numerous cases, is so much greater than the power that the latter can be generated purely as a by-product of the heating, and eighty percent of the heat from the steam passing through the power engine will enter the heating system with just as good results as the same amount of steam direct from the boilers.

The belief has become general that boilers at low pressure take very much less coal than high pressure boilers would. By high pressure, we mean from 150 pounds up, and by low pressure, boilers built for not more than 25 pounds working pressure.

Steam pressures are believed

(*Continued on page 70*)

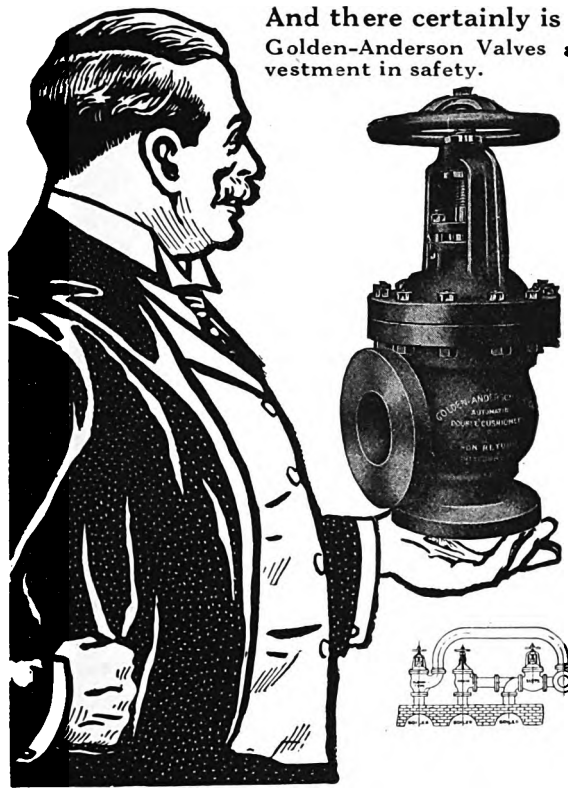
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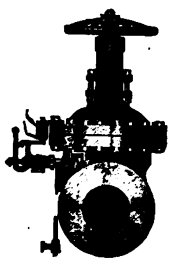
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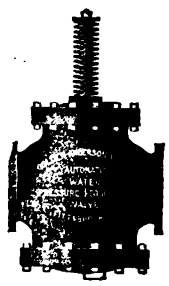
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"Every Valve sold with a Positive Guarantee."

1. They will cut off a boiler instantly when one of tubes bursts.
2. They will prevent live steam from entering a cold boiler, thus insuring safety to workmen.
3. They instantly shut off the steam from all boilers when a pipe breaks.
4. They can be opened or closed by hand in the same manner as ordinary gate or globe valves when fitted with the patented safety latch.
5. Double cushioning prevents absolutely all pounding or chattering.
6. Automatically equalize the pressure between all boilers.
7. Are equipped with double Corliss Dash Pot that cushions it opening and closing.
8. Cannot pound, spin, stick or chatter.
9. Every valve sold with a positive guarantee
10. Safeguard the men and safeguard the property.



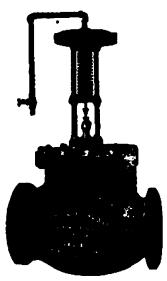
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May be tested while in service giving complete assurance of safety.
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Will establish positively steady reduced water pressure. Easily adjusted from the outside. Fitted with patented safety piston to remove danger of high pressure from reaching low pressure side. Cushioned by water and air. No shock in seating.
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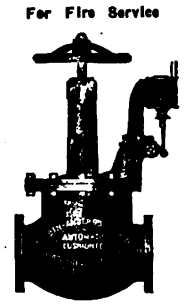
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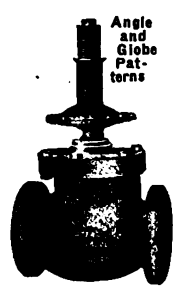
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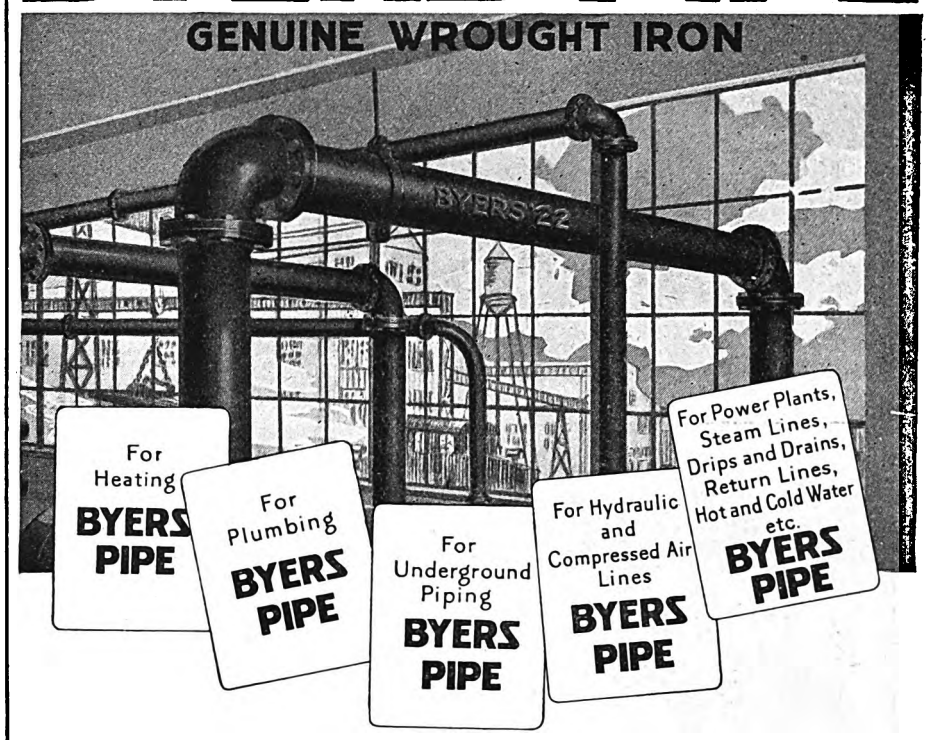
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Golden-Anderson Valve Specialty Co.

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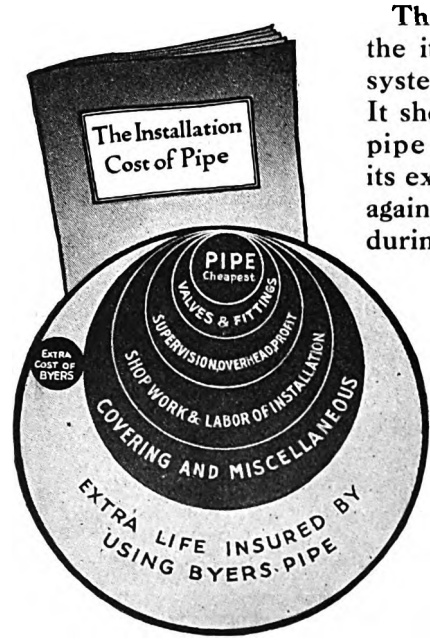
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The diagram below, representing the items of cost in the average pipe system, illustrates the point forcibly. It shows why the extra cost of Byers pipe is insignificant compared with its extra life in service, which insures against heavy replacement expense during the useful life of the system.

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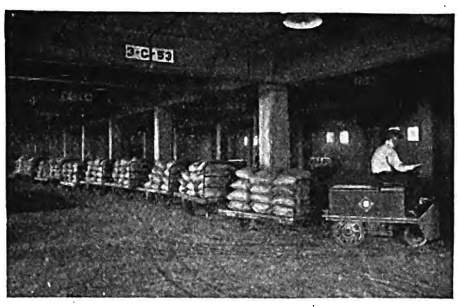
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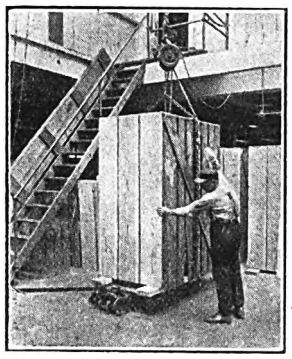
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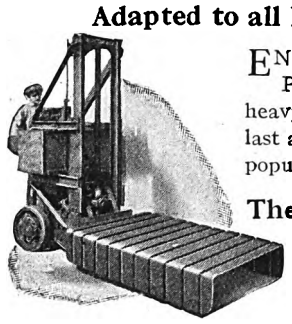
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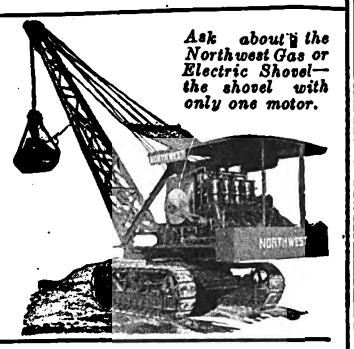
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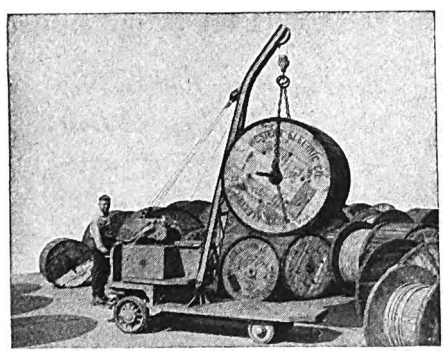
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is on Electric Industrial Trucks equipped with **REVOLVING CRANES.**

Bulletin 51 tells how.

The Elwell-Parker Electric Company
Cleveland Ohio

HANDLING

(*Continued from page 68*)

to have a direct and important bearing on steam costs, but in fact, have little influence on them. The fundamental laws of steam manufacture are such that steam pressure has little effect on the amount of coal required to produce it. For example, steam at the pressure of our air, contains, in round figures, 1151 heat units per pound of avoirdupois. Steam at 172 pounds pressure contains about 1197 heat units in the same kind of a pound.

From these *facts* it will be seen that by increasing steam pressure several hundred per cent, the heat content is increased an insignificant amount. In simple language, 16 ounces of steam at 172 pounds pressure has only four per cent more heat than the same quantity of steam contains at atmospheric pressure. Practically it would take no more coal to produce the same quantity of steam at 172 pounds pressure or higher than it would at 5 pounds pressure, as coal records in the best power plants seldom check within 5 or 6 per cent.

This is the fundamental reason why all large power plants are designed and built for high steam pressure; as by adding an insignificant amount of heat, the steam can be increased in pressure many fold and thereby add to its capacity for doing mechanical work.

On account of these facts, it is little short of an economic crime to blow steam into a multitude of heating systems at low pressure, without first taking therefrom the mechanical work that this steam would be capable of performing, if it were raised to a reasonable working pressure, and with no appreciable increase in the amount of fuel required to do so."

It is in this new conception of the heat equation of the plant as a whole that the small steam turbine is coming to be recognized more and more as a powerful factor in cutting the cost of the coal pile. For these compact and easily operated units are unrivalled in helping the engineer to most profitably compensate his heat equation for variations in power requirements, in exhaust steam requirements and in hot water requirements. Sometimes this is done by the installation of "bleeder" or extraction turbines, sometimes with back pressure turbines which utilize the heat fall between the engine exhaust and the condensate temperature, turning it into usable power. Valve arrangements may be provided with modern turbines that act automatically in varying the turbine action and the conditions of entering and exhaust steam so as to make an automatic controlling unit of the turbine whose purpose is to act as compensator in the plant heat equation. Thus, one of our illustrations shows a turbine which by means of such valves, automatic in their action, operates at different times as, first a high pressure condensing turbine; second, back pressure turbine; third, extraction turbine; fourth, mixed flow turbine; fifth, low pressure turbine. These rather complicated actions are carried out by means of three simple valves. Two of these valves are controlled by the speed governor, one admitting live steam to the high pressure and of the turbine, and the other admitting low pressure steam to the low pressure end. The governor levers are so arranged that the valve in the low pressure connection always opens before and closes after the high pressure valve, so that the turbine will utilize any surplus low pressure steam before it will draw upon the high pressure steam. The third valve is also in the connection to the low pressure end, and is controlled by the pressure in the low pressure piping. When the pressure in the latter rises, that is when there is a surplus of exhaust steam from other sources, this valve opens, but when the pressure in the low pressure piping is low, as it is when more steam is needed for heating water, etc., this valve closes.

Steam turbines in industrial plants offer large possibilities in the way of economizing fuel, the various "hook ups" which can be employed with them should be more widely known. One interesting example is the use of a steam turbine in connection with the operation of a large paper machine. Here the exhaust of the turbine is used for heating the rolls. It was found that the current required to drive the paper machine did not load the turbines

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sufficiently to produce enough exhaust steam for heating the rolls. In this case an alternator which was coupled to the same shaft, served to load the turbine to the point where sufficient exhaust steam was secured and also furnished alternating current to the general power circuit of the mill.

It is becoming quite common now to provide duplex drives for auxiliaries in condensing power plants in order to be able to regulate the amount of exhaust steam according to the feed water heating requirements. An AC generator and a DC generator are coupled to a turbine. The DC generator is used as an exciter and the power to drive it can be supplied either by the AC generator acting as a motor or by the steam turbine. The turbine can also drive both of the electrical units as generators when the feed-heating requirements are exceptionally large, as during peak load periods, the AC power produced at such times being sent back into the main circuit and relieving by that much the demand upon the main generator.

The development of the small turbine from 1 hp. to 10 hp. and of fractional horsepower sizes has led to a great many efficient uses for these units coupled to a number of varieties of driven apparatus. Prominent among these are forced draft fans or blowers which may be inserted directly in the ash pit wall of a boiler and not only enable cheaper grades of fuel to be burned but respond very quickly to heavy demand or overloads. Oftentimes these are automatically controlled by pressure governors so that a consequent steam pressure may be maintained in the boiler regardless of load requirements.

The development of the reduction gear has had a large place in widening the field of the modern turbine. Aside from the small power units the reader will notice that practically every installation shown in this article comprises a reduction gear. Before the perfection of suitable speed reducing apparatus it was generally necessary to compromise between suitable speeds for the turbines and the driven apparatus, at a sacrifice in efficiency of both. Now it is possible to maintain the high turbine speeds which mean both compactness and economy and to select exactly that speed which is best suited for the driven apparatus, by means of a gear reduction.

With all of these improvements the modern steam turbine fits effectively into the heat equation of the modern factory.

Food Distribution as an Industry

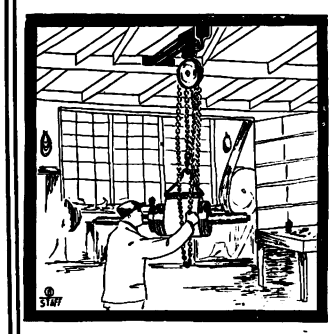
(Continued from page 13)

purchase all goods in carload lots, whenever possible, and have them shipped direct to their warehouse sidings. The unloading of these cars had to be done quickly and it was often necessary to draw labor from the main warehouse floor to assist in getting the cars unloaded.

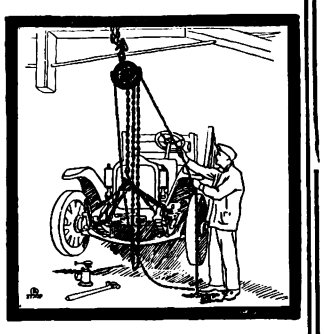
The old method required from 2 to 3 men per car or approximately 8½ man hours to unload a car of 1000 cases. These men used to pick the goods up within the car, carry them to the car door, and place them on platform skids. When a skid was loaded the electric truck would take it to the store-room. These men are paid 42 cents per hour, which places a cost of $3.57 against 1000 cases for unloading, or a charge of $0.0035 cents per case.

The second picture on page 12 shows the present method of unloading cars by means of gravity conveyors. This conveyor eliminates the labor of carrying the goods from the end of the car to the door and thus speeds up the work, so that now 1000 cases are unloaded in 6 man-hours. This saving of 2½ man hours reduces the cost to $2.25 per 1000 cases, or a charge of $0.0025 cents per case. Since these men unload on the average of 4000 cases per day the use of conveyors is saving

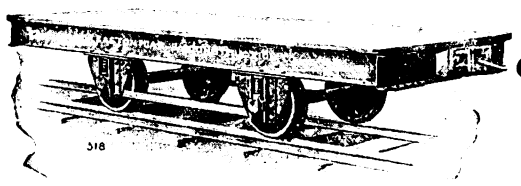
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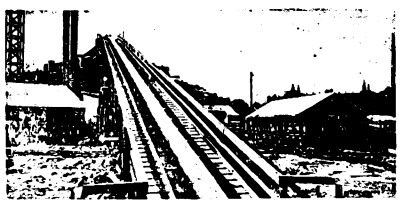


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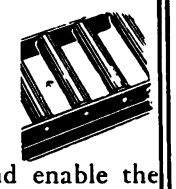


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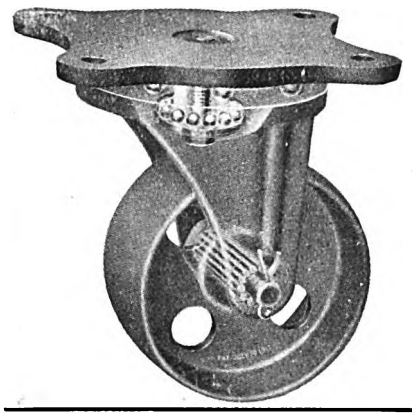


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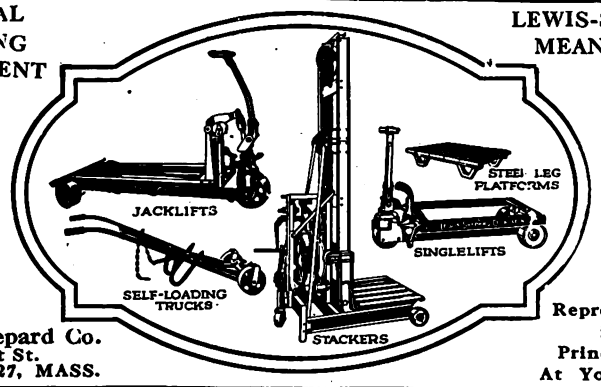
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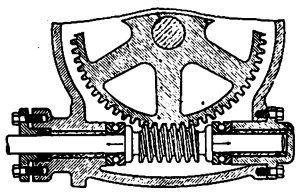
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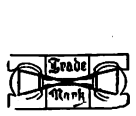


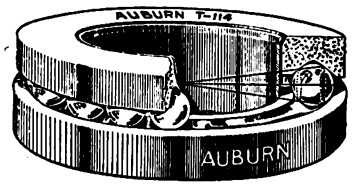
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HANDLING

$4.08 per day on car unloading alone. These conveyors are portable and can be used on other operations within the warehouse, where they are also effecting additional savings of time and money.

If the old hand method of unloading cars by means of common hand trucks were attempted the plant superintendent believes that first of all the cost per case would be at least three times as much as the present method, and second, it would be impossible to handle the goods.

Another point where a comparison can be made between old and new methods is on the operation of piling goods in the surplus stock storeroom. The old practice used to be that of bringing a loaded skid from the cars and placing it on the floor. The second loaded skid was placed beside it and two men piled the cases from the second skid on top of those carried on the first skid. This meant another rehandling when the cases were taken out of surplus stock and placed on the picking floor. Thus the two additional handlings added $0.005 cents per case or $5.00 per 1000 cases for those which of necessity had to be placed in surplus stock and piled.

By using a tiering truck and piling the loaded skids, one on top of the other as shown in the lower left hand corner of page 12, this additional expense was eliminated and the work done without delay. When the tiering truck is not being used to pile loaded skids it operates the same as a lift truck and transports materials about the warehouse.

After the orders from the different stores have been properly received at the main office and the necessary billing has been placed against the various store accounts, they are sent direct to the warehouse picking floor. The upper right hand corner of page 13 shows a general view down the main aisle of this floor. Here the order pickers remove the different items from stock skids and place them on trailers. Each trailer carries a separate order and in no case is more than one order placed on a trailer; but quite often the orders are so large that it requires two or three trailers for one order.

There is another point to be considered. One picker does not pick the entire order; the with completed orders. The order blanks being made up in such a manner that it is easy to detach for each section of the warehouse and each order picker works only within a particular section. This is quite an important point and one that makes it possible for the order pickers to do their work quickly and efficiently. When the order picker notices that a certain commodity is running low he arranges with the operator of the electric lift truck to bring a new loaded skid from the surplus stock room. In this way only the really necessary stock is carried on the order picking floor.

In this warehouse is embodied a feature that is often overlooked: namely the entire warehouse is on one floor level and is known as a single floor warehouse. This form of layout eliminates the delays of waiting for elevators to carry goods between floors. Previous to acquiring this new plant the Bohack Company operated a three-story warehouse, and the older men who have worked in the old building and the new building assert that it would be impossible to accomplish as much with the old layout as they now accomplish with the new layout.

After the orders are placed on the trailers, the trailers are placed in the main aisles and the order picker starts on the next order.

At this time the electric tractor comes into operation, and it is the tractor driver's duty to keep the aisles clear of all trailers that are loaded with completed orders. The view in upper center of page 13 shows the tractor pulling a train of trailers from one section of the order-picking floor, to the shipping bays on the truck loading platform. Looking closely, it will be seen that each trailer load appears to be identical. This is because the loads are all coming from one location in the warehouse. When this train of trailers arrives at the shipping bays it is placed in the forward space shown at the right, where it is checked and then moved by hand into the further bays, where the entire order is consolidated and again checked. It

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has been found that frequent checking pays, as it reduces mistakes and expense of returning to the warehouse goods that were not ordered by the store manager.

The same attention is paid to the loading of trucks as has been carried out through the different steps of unloading from the cars, placing the goods in stock, etc. When the trailers are moved to the further bays on the truck loading platform, they are placed in such a manner that the goods to be removed from the truck at the first stop are placed on the truck last. Having the goods on trailers at this point, instead of on skids, allows the truck loaders to push the loaded trailers directly into the truck, thus eliminating the necessity of carrying each item from the tail board to the front end of the truck body.

To give an idea of the speed of loading these auto trucks and a further idea of how many tons of goods are handled per day in this plant and also to show the economy that can be maintained by the use of material handling equipment, the writer will include a portion of the study made by him on the truck loading at this modern food distributing plant.

Each truck is loaded one to three times per day, depending upon the length of haul and the territory served. It is not unusual for from ten to fifteen trucks to arrive for the second loading within twenty minutes. This requires a speedy crew to load these trucks, so that no time may be wasted in waiting between loads. With the arrangement of all orders on trailers and the consolidation of these orders, 6 men have loaded 13 trucks in 1¼ hours time—loading 3,090 pieces of merchandise or approximately 69 tons of materials to be delivered to 37 stores. This is a remarkable feat, but not unusual at this plant, although the writer has never seen it duplicated at any other.

At the present time the grocery warehouse department is operated with a force of 29 men, 11 of whom are order pickers, 14 are car unloaders and truck loaders, and 4 are used to operate 2 electric lift platform trucks, 1 tiering truck and 1 tractor. When we consider that each order picker picks about 550 items in an 8-hour day, it means that on the average 6000 pieces of merchandise are taken out of stock each day and 7000 pieces are placed in stock. This total of 13000 pieces to be handled each day is the best indication that this modern food distribution plant is run efficiently.

The meat department is separate from the grocery department, is operated independently, and has its own labor force. The work in the meat department is not so complicated and is all handled by means of overhead carriers, plain, and rack trucks. The center view, page 13 shows the truck loading and unloading platform of the meat department and the picture in the lower right hand corner shows an interior view within the cold storage-room. The meat department has a complete turn-over of stock at least four times a week.

The company has paid considerable attention to the interior of their distributing plant but they have not in any way neglected the main artery that ties the warehouse in with the stores: namely, their delivery trucks. These trucks are of various makes, as the company is trying to see which make will be adopted as standard, and of various capacities, from 2 to 7½ tons. These cars are given the best of care and all repair work done in the company's own repair shop. This shop is well equipped and the company has found it pays to maintain their own repair department. The work is so well taken care of at the slightest sign of trouble that it is seldom found necessary to keep a truck out of service for more than a day or two; but the company maintains extra trucks in the garage for emergency, for they realize that it is important to deliver the goods when they are called for and without delay. The view at the bottom of page 13 shows the interior of the garage.

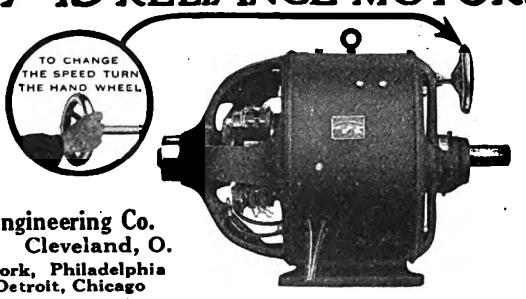
The entire problem of food distribution is really a matter of handling materials from one place to another. If this work is not properly done the consumer, the public, must bear the expense. This is also true in the manufacturing of goods at the producers' plants.

POWER

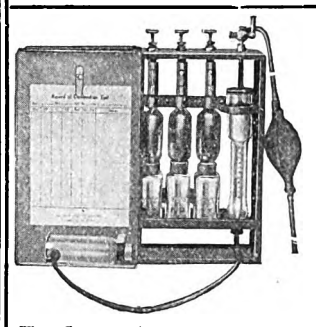
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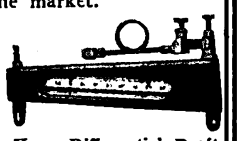
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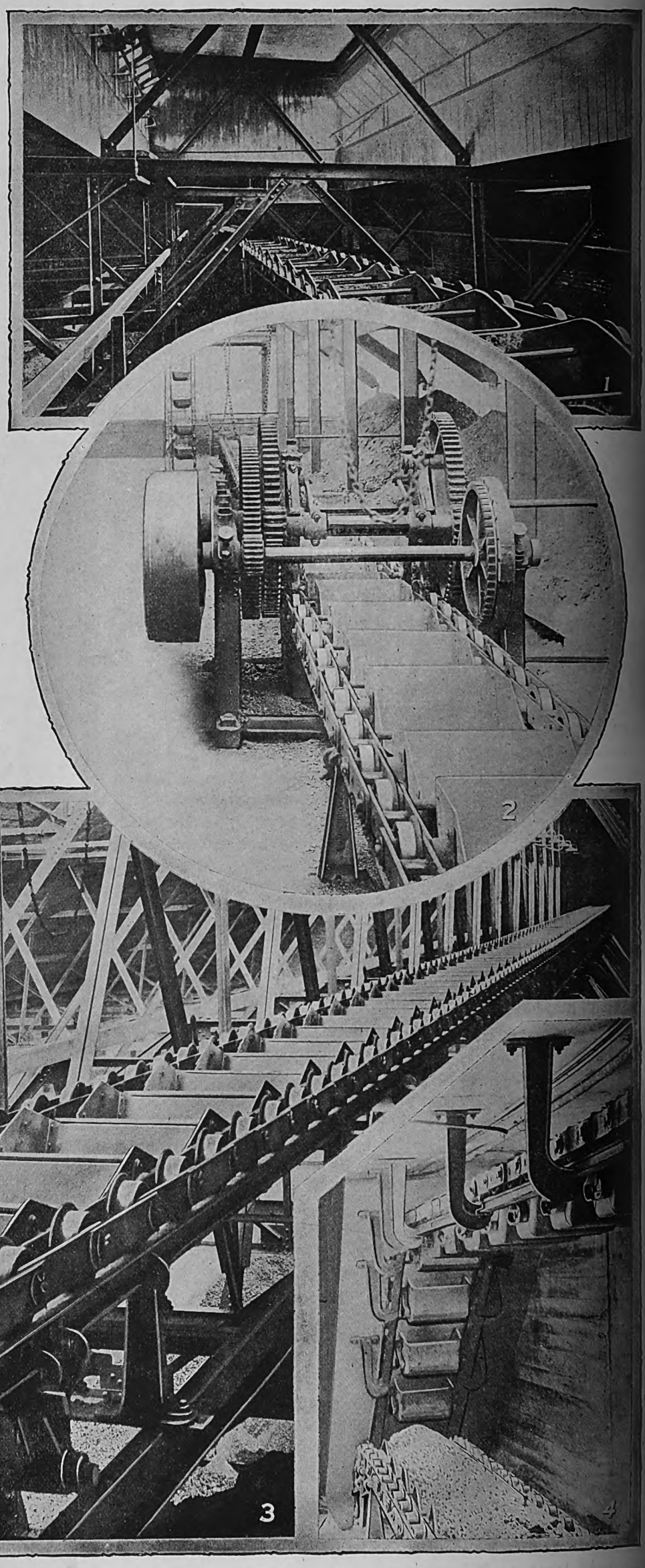
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2. Hunt Pawl Driver which insures an even pull on conveyor chain at all times.
3. Conveyor with sheet steel buckets for handling coal installed in large Pumping Station.
4. Upper and lower run of conveyor with sheet steel buckets showing one of the many methods of supporting conveyor.

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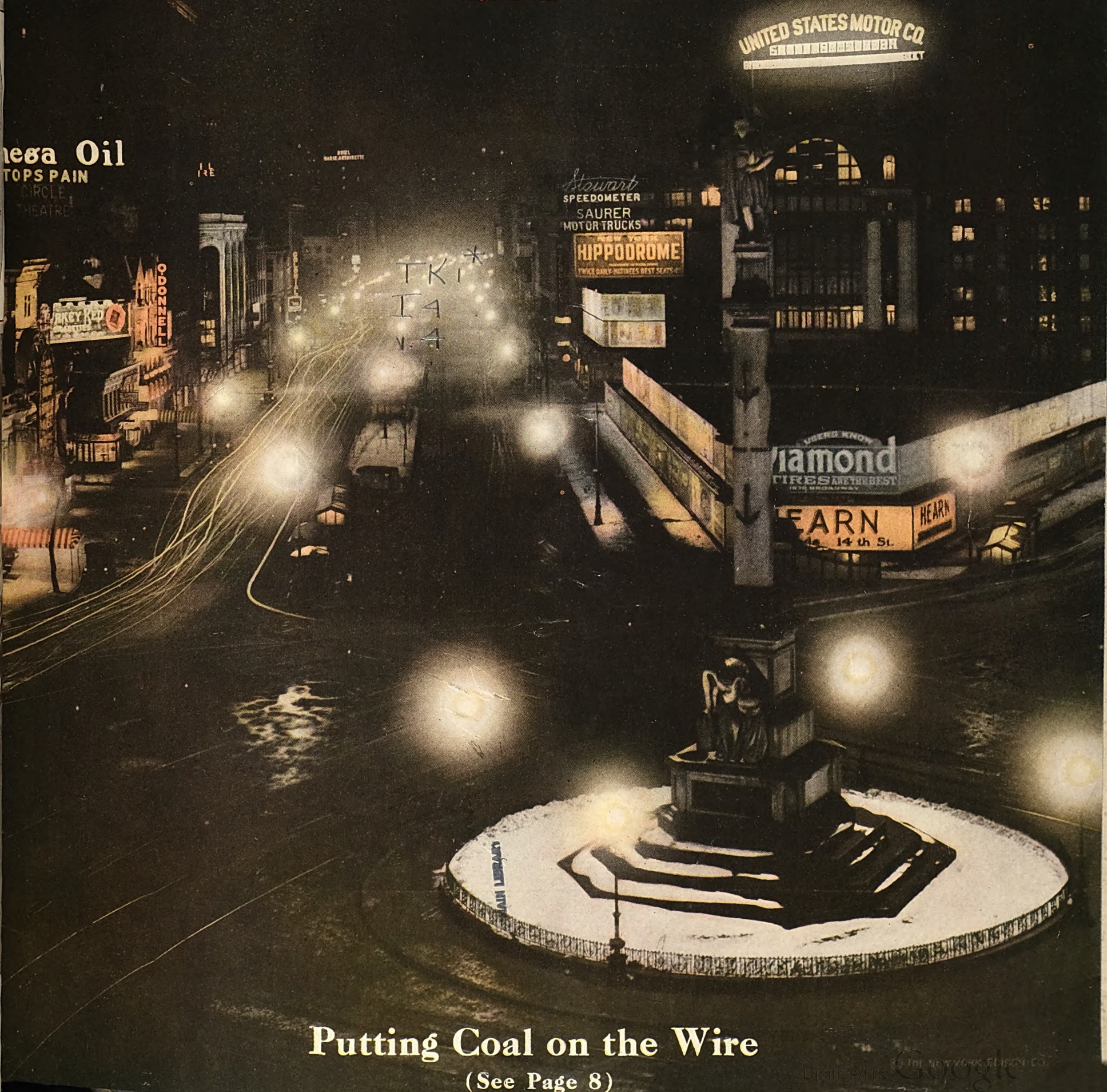
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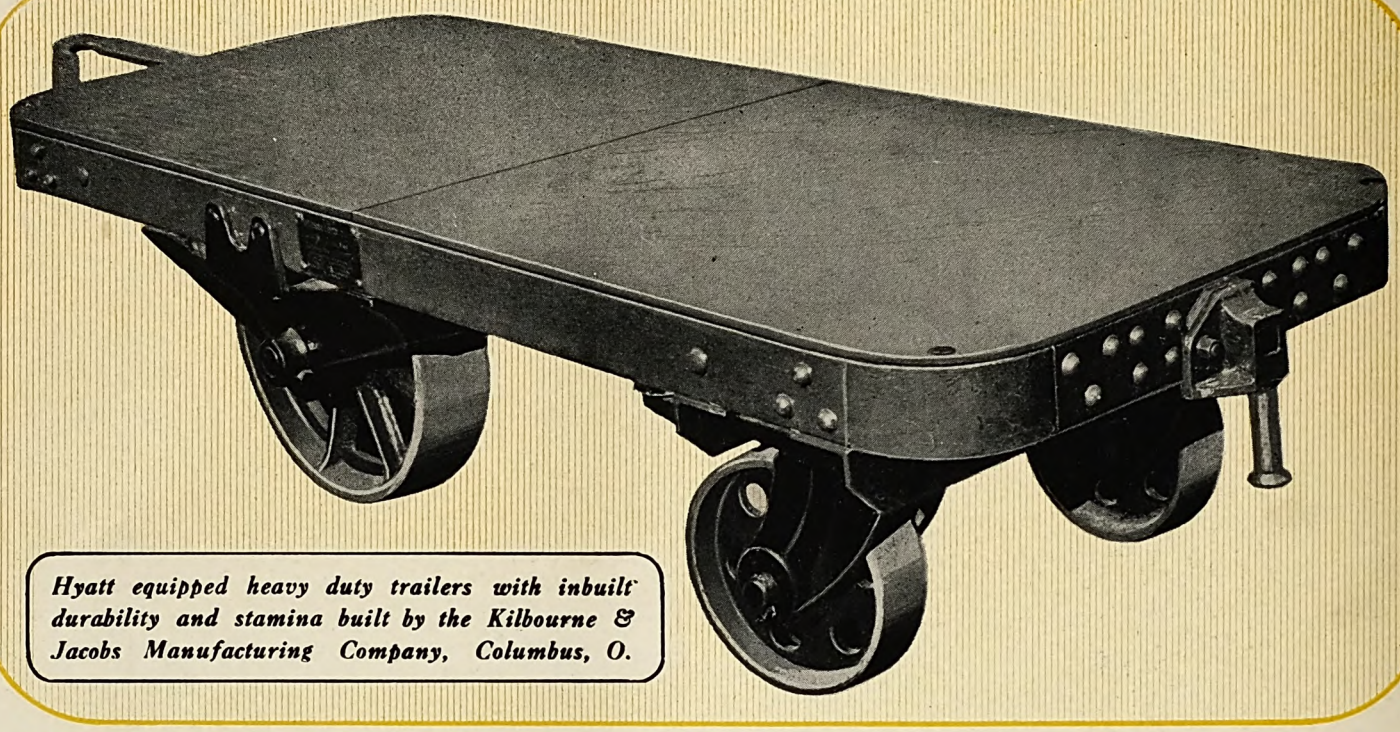
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Putting Coal on the Wire

(See Page 8)

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Hyatt equipped heavy duty trailers with inbuilt durability and stamina built by the Kilbourne & Jacobs Manufacturing Company, Columbus, O.

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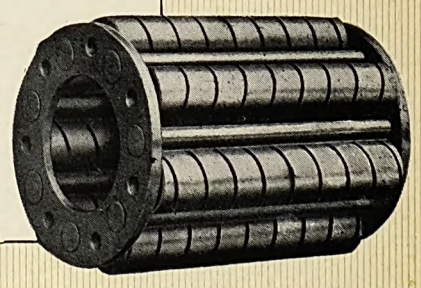
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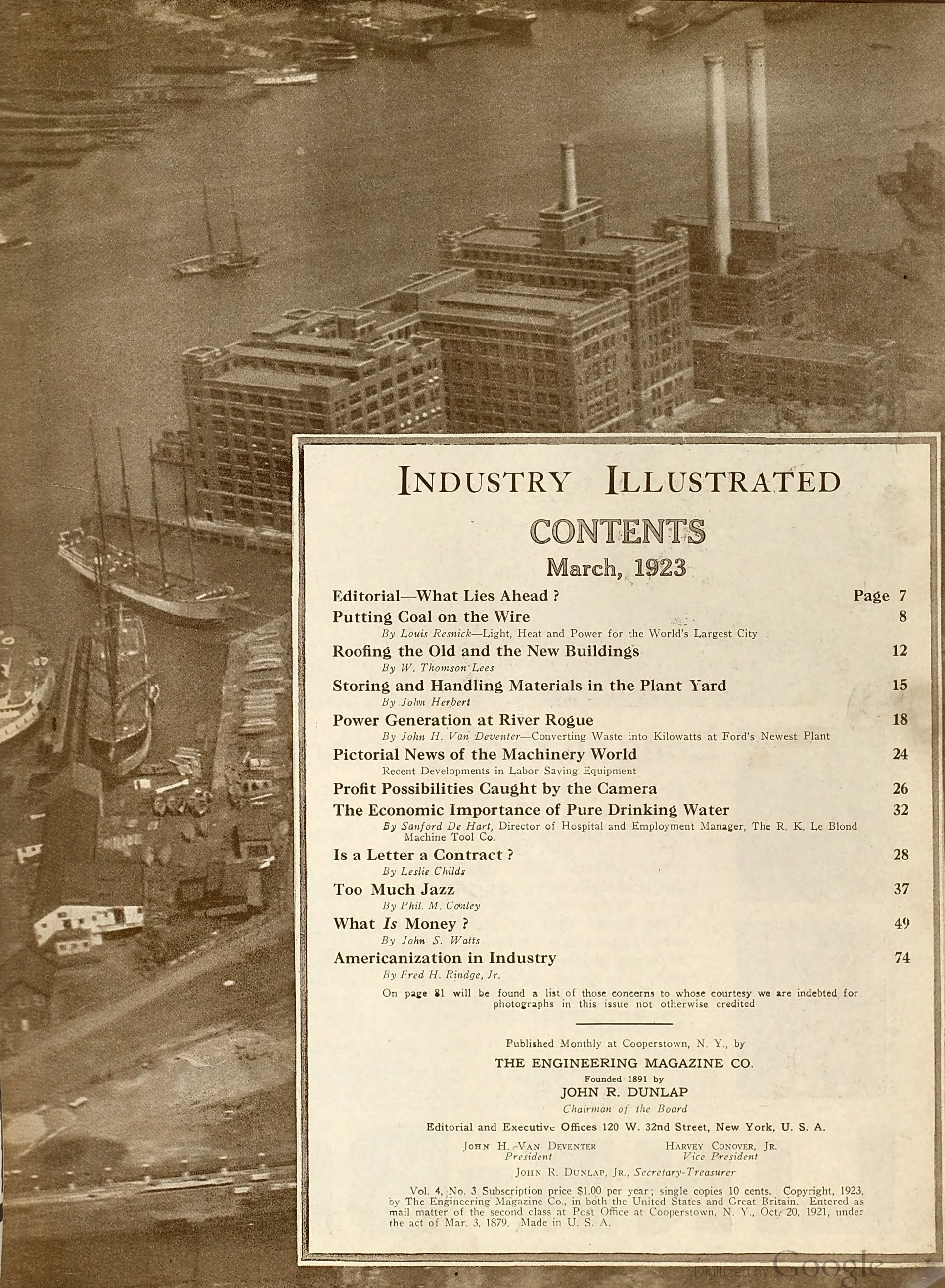
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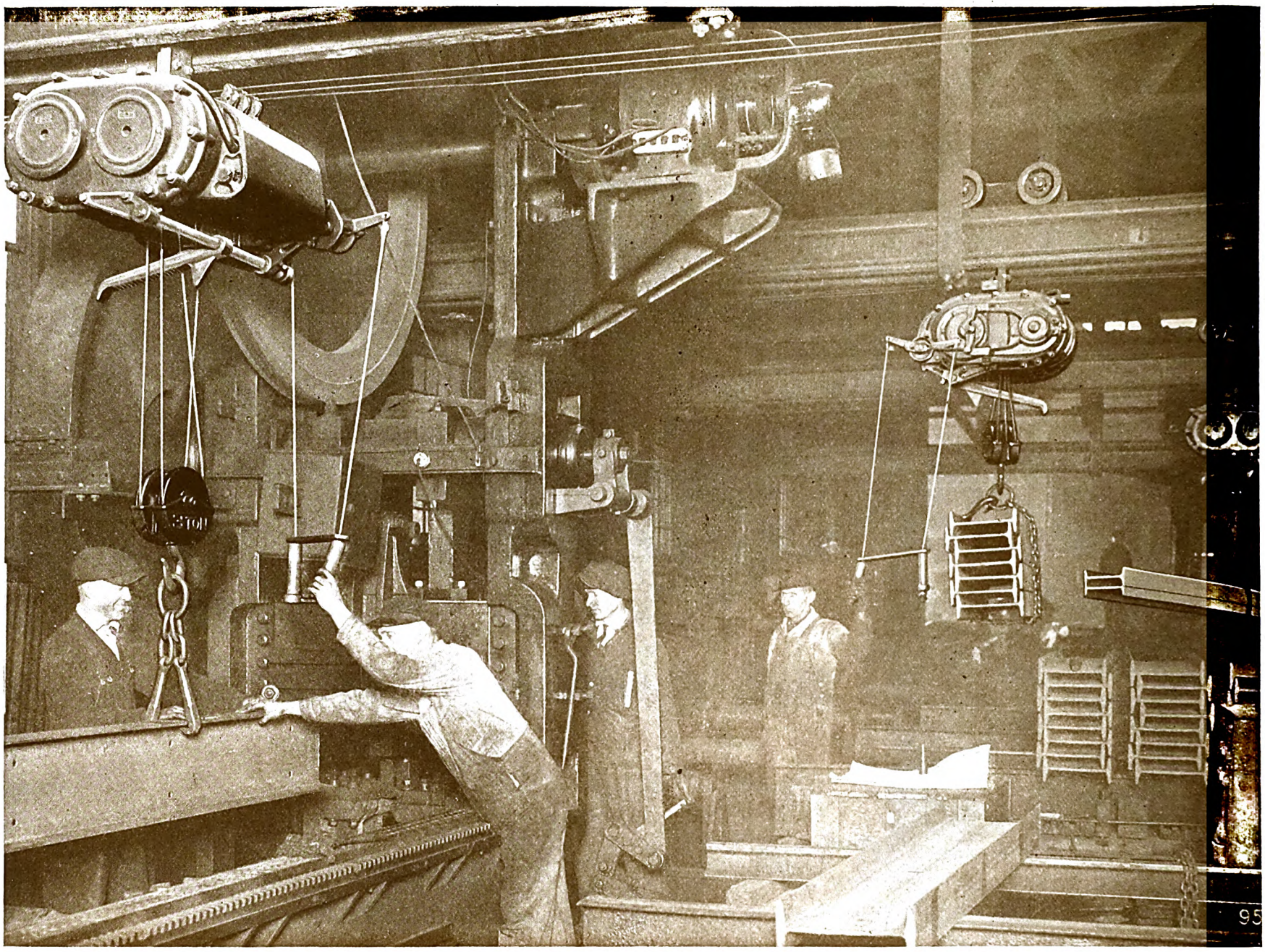
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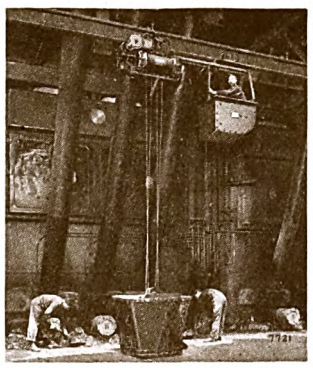
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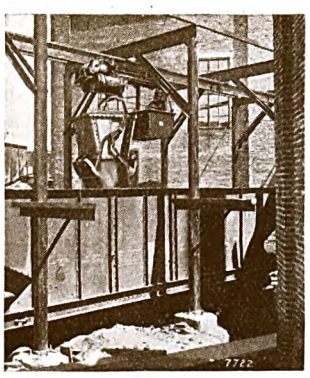
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Hytor compressors are quiet in operation.

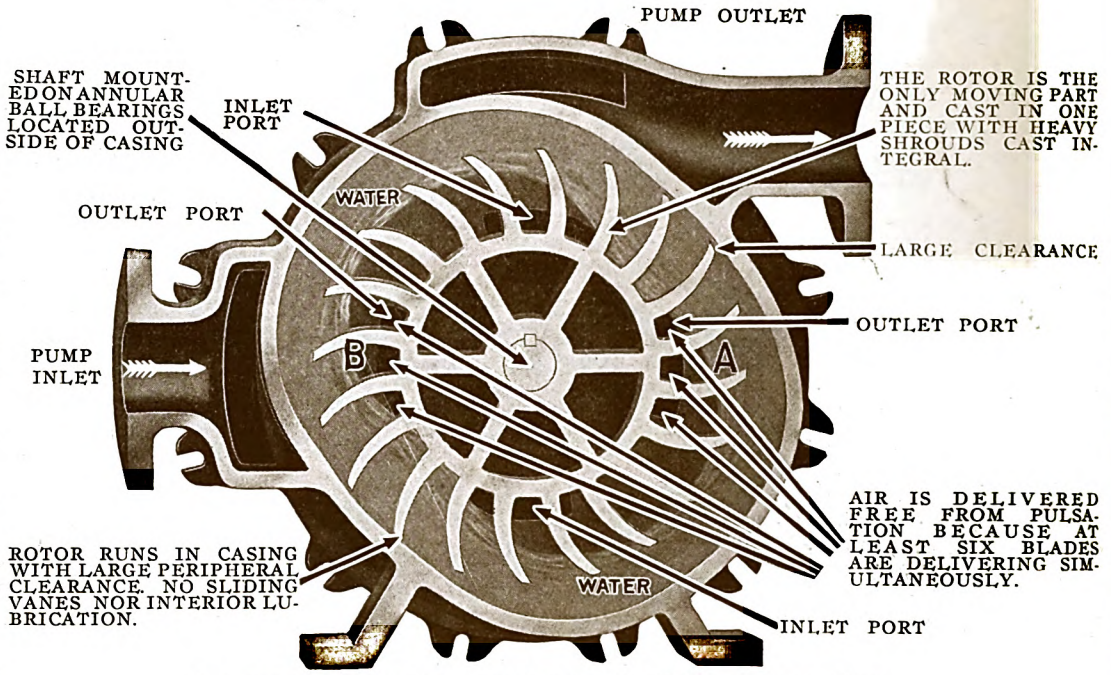
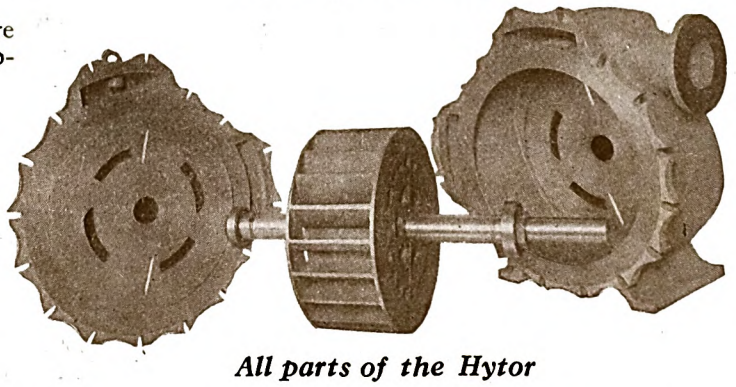
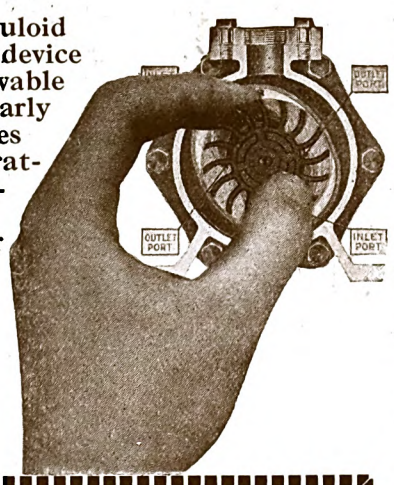


Diagram illustrating unique principle of operation



A ROTOR in hydraulic balance revolves freely in an elliptical casing filled with water. The water, turning, with the rotor, and constrained to follow the casing by centrifugal force, alternately recedes from and is forced back into the rotor, twice in a revolution. As the water recedes from the rotor it draws in the air through the inler ports. When the water is forced back into the rotor by the converging casing, the air is first compressed and then discharged through the outlet ports.

This celluloid graphic device with movable rotor clearly illustrates the operating principle. Send for your copy.

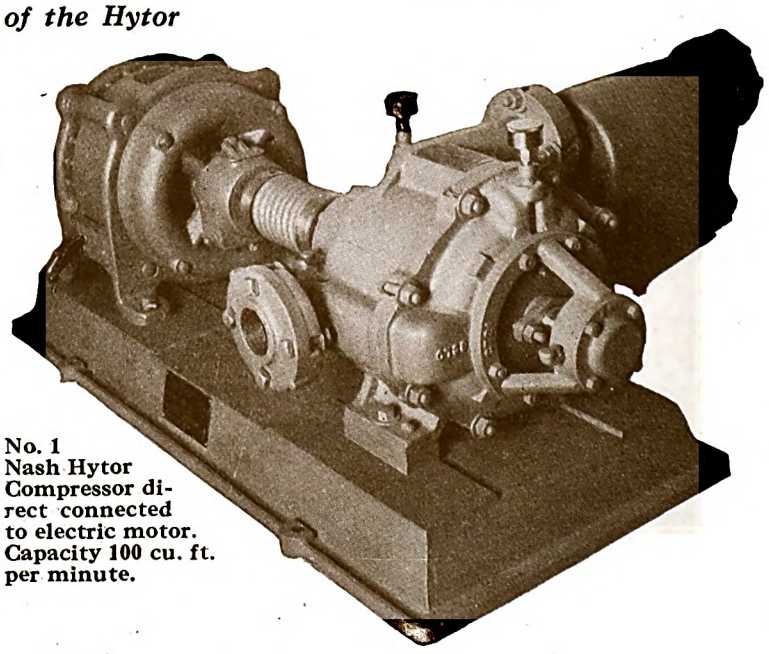


All parts of the Hytor

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No. 1 Nash Hytor Compressor direct connected to electric motor. Capacity 100 cu. ft. per minute.

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Industry Illustrated

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EDITORIAL

What Lies Ahead?

IT is true that, in the light of past practice and present knowledge, we have made great strides in conserving our power resources. We take just pride, for example, in such remarkable achievements as that of the Ford Motor Company in its River Rouge Power plant. Yet, as a matter of fact, we have so far concerned ourselves only with the *conservation of resources;* we have not even begun to attack the larger problem—the *conservation of energy.*

For many thousands of years, mankind has lived and grown and multiplied, deriving the energy necessary for existence and growth from the products of agriculture. Nature provided a complete cycle of events to make this possible: man (together with all animal life) burns up as food the vegetables and plants, utilizing their energy and giving off carbon dioxide and water as waste products; the vegetable kingdom, acuated by energy from the sun, converts these waste products again into food and fuel—a process called "photosynthesis." Without solar radiation, however, the vegetable kingdom cannot function. Thus, all the energy in our foods, as well as all the energy in coal or oil, is in fact but so much stored-up energy originally derived from the sun.

So long as civilization was based upon man-power and beast-power—animal energy—it was self-supporting; the energy consumed was less than the solar energy simultaneously being stored up through photosynthesis But today's civilization is not based upon animal power; it is to an ever-increasing degree dependent upon mechanical power—dependent at present upon the energy derived from coal and oil as fuels. And, whereas Nature provides each year a new crop of the fuel which supplies animal energy, she has produced, in countless thousands of years, but a single "crop" of the fuel from which we derive mechanical energy.

Occasionally one hears it said that man has progressed so far, achieved so much, that there are few problems left to solve. Right here, however, is a problem beside which all the accomplishments of the past sink to insignificance:—when we have exhausted all the energy stored up in the form of coal and oil, where shall we turn for the mechanical energy on which our civilization hinges? Perhaps we shall discover a form of vegetation which can be economically grown and used for fuel; perhaps a cheap and prolific crop that will render a high yield of industrial alcohol. Both of these paths are under investigation by scientists, and the latter seems to hold out some promise.

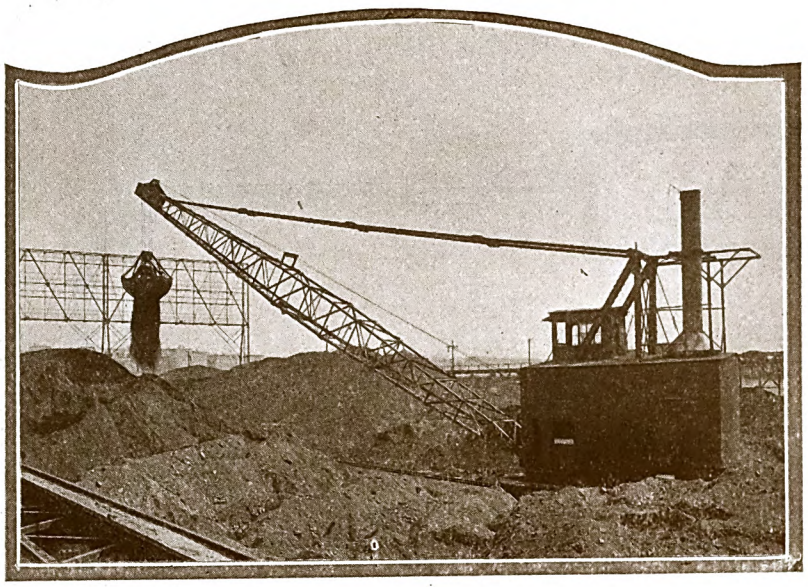
Whatever the solution may prove to be, here is a problem for those jaded intellects which sigh for new worlds to conquer and complain that nothing really vital remains to be done.

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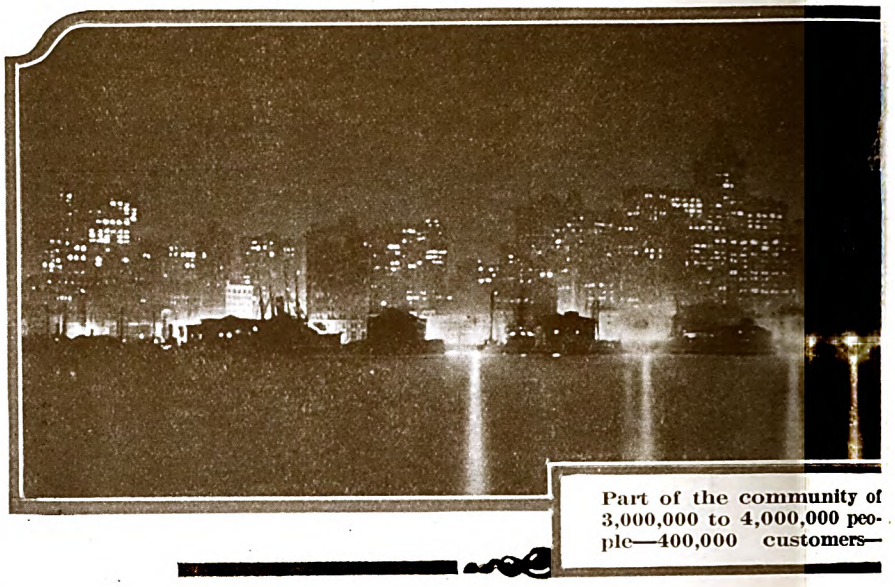
Putting Coal

Light, Heat and Power for

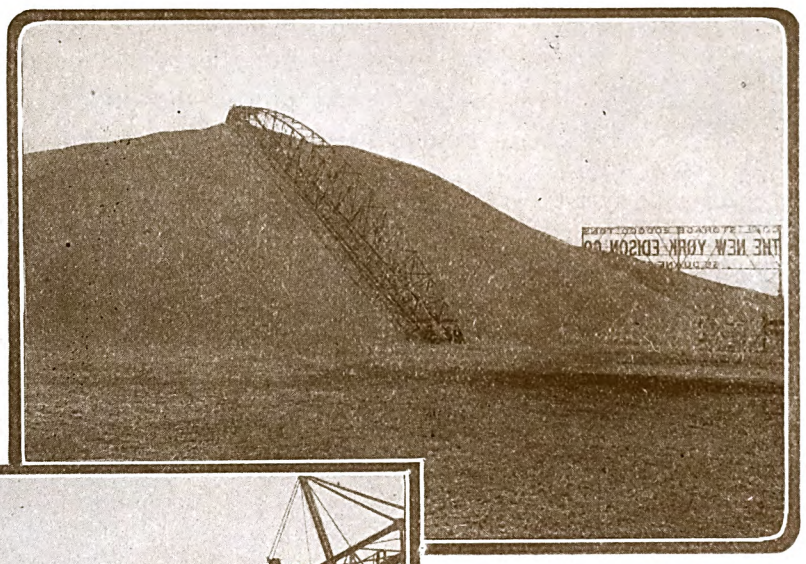
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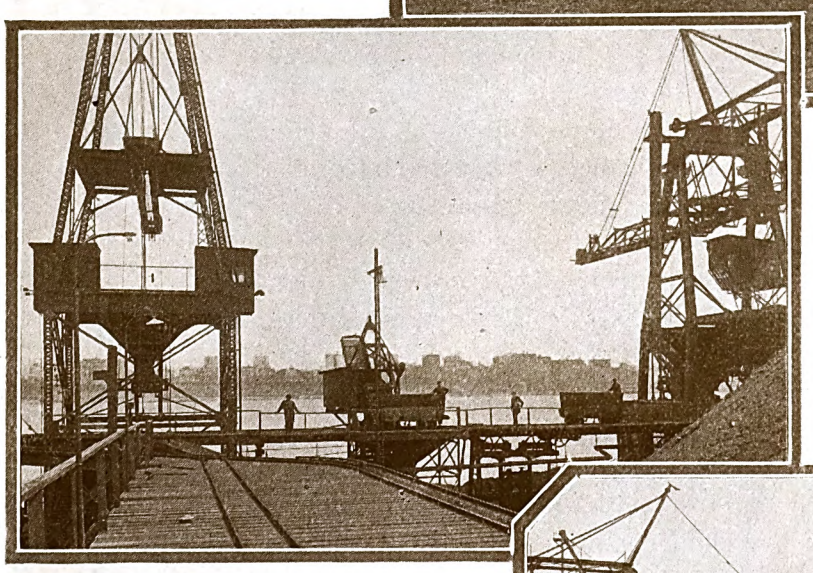
It is estimated that there are about 5,000 tons of coal in these piles; That is the raw material which The New York Edison Company each day converts into more than 6,000,000 kilowatts of electrical energy.



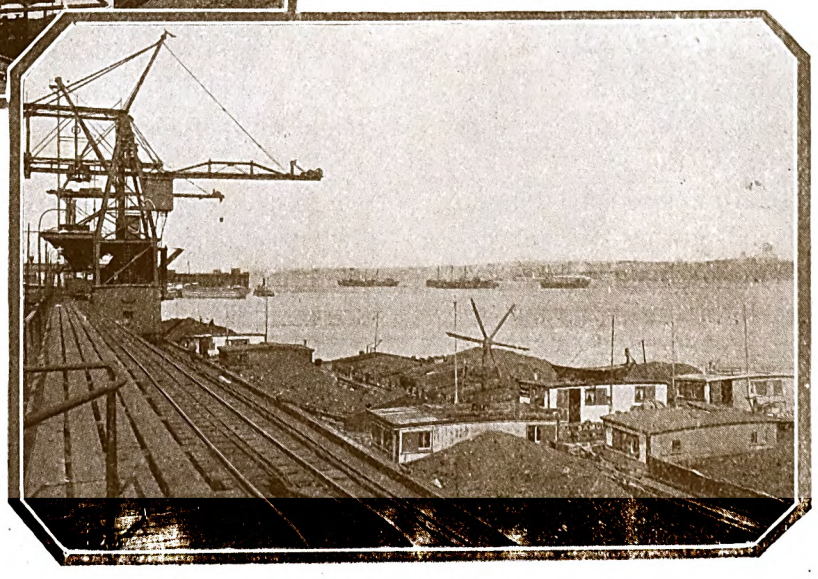
Part of the community of 3,000,000 to 4,000,000 people—400,000 customers—



Another pile of 67,000 tons at Shadyside.



The boisting tower and the waterside terminal of the bridge-tramway which, together, enable Shadyside to load or unload 2500 tons of coal in ten hours. In numerous emergencies, when New York's coal supply has been shut off by strike or storm, the loading equipment at Shadyside has been operated for twenty-four or forty-eight hours without a stop.



Twelve mines send the coal required to feed the furnaces of Waterside. The daily supply, six bargeloads, on the dock at Shadyside, N. J., where an emergency supply of 200,000 tons is stored.

GIVEN 5,000 tons of coal a day, and a community of three to four million people requiring an unfailing supply of electrical current for light, heat, and power, convert the coal into something over 6,000,000 kilowatts of electrical energy and deliver it safely and at a uniform voltage to some 400,000 customers; if a storm or London fog comes up, find out about this an hour before the rest of New York does and, if necessary, be prepared to carry your peak load for twelve hours at a stretch instead of one; and, finally, keep on hand in an accessible place enough emergency coal to carry you through any coal famine, be it the result of railroad strike, miners strike, harbor tie-up, or any other cause.

That is part of the problem confronting The New York Edison Company every day in the year, the part that this article will attempt to describe. The various other phases of the problem—showing 400,000 customers how to make the most economical use of a commodity that none can see and comparatively few understand; making the customer realize that his meter registers whether he or the scrubwoman uses the service; supplementing electric service with all the personal service necessary to please the whims of millions; doing all this today at a lower cost to the consumer than ever before—are all interesting, but

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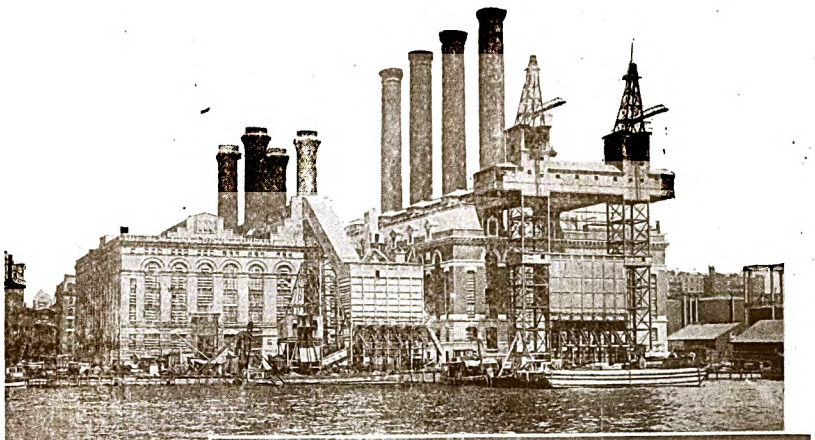
on the Wire

the World's Largest City

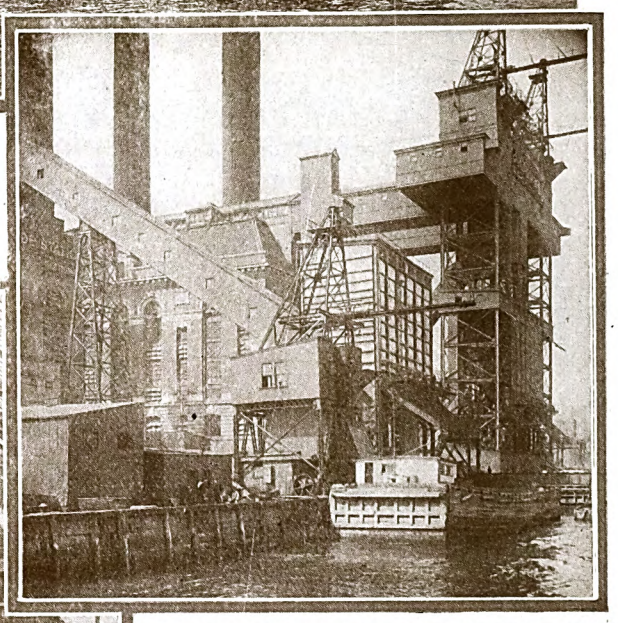
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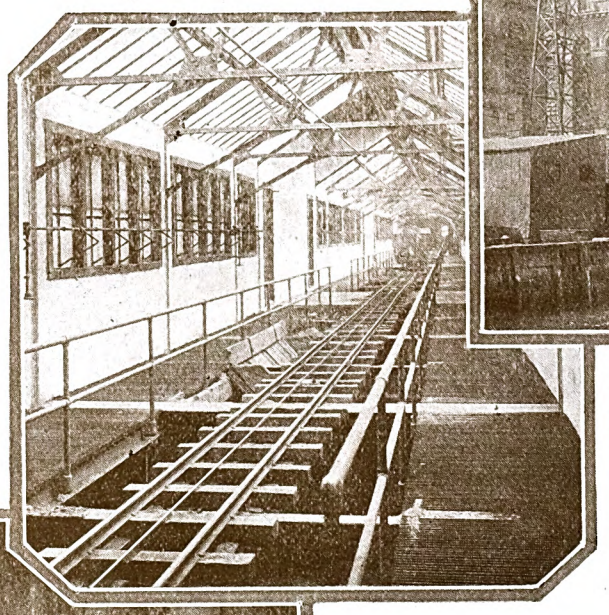
dependent upon one central station system for light, heat, and power.



These two buildings, operated as a unit, contain what is probably the largest battery of turbine generators in America, 20 machines with an aggregate capacity of 324,000 kw.

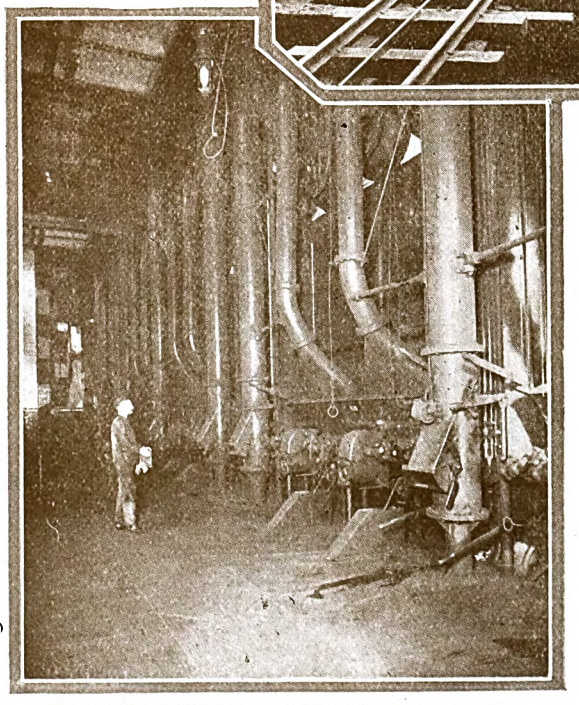


Closeup of the coal tower at Waterside where three buckets, each taking a ton and a half at a time hoist the coal from barges 180 feet above the water in 30 seconds.

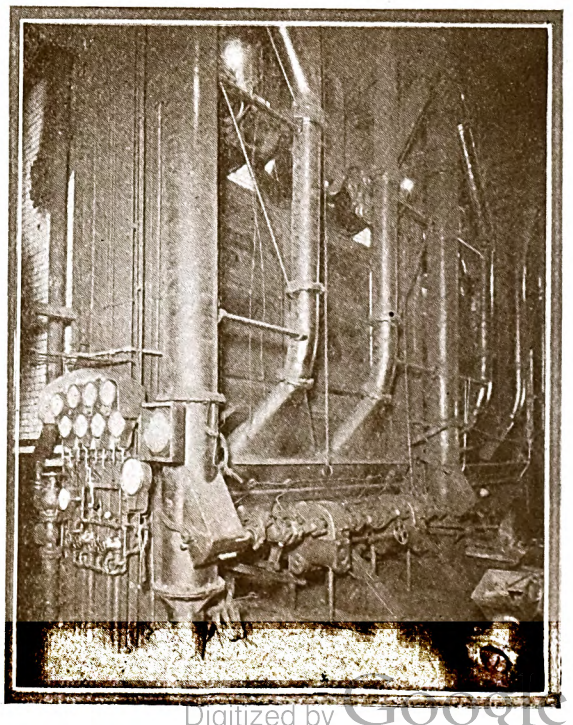


The cable car system at Waterside where automatic trips drop the coal into the bunkers needing it.

The centralized air control system (lower left) which enables one man to regulate the air for all 92 boilers in Waterside No. 2 and another man to control the air for the 54 boilers in Waterside No. 1.



Six of the 146 boilers, each 650 horse power, which carry out the first step in the process of putting coal on the wire by producing the steam to drive the turbine generators. The clean hands, face, and polished shoes of the workman in the foreground are symbolic of the modern boiler room.



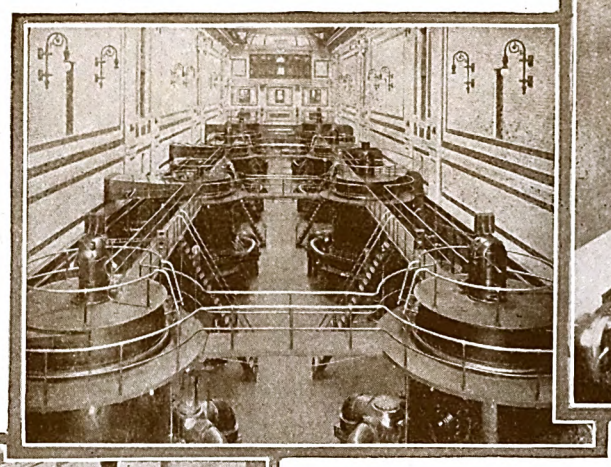
it would take as much space to tell the story of each as it does to tell how the central station puts coal on the wire.

The particular central station described in this article is known as Waterside No. 1 and Waterside No. 2 extending from 38th street to 40th street and from the East River to First Avenue, New York city. Although it is one of the five generating stations of the New York Edison system (The New York Edison Company and the United Electric Light & Power Company), it takes care of approximately half of the entire load of that great system. It is the direct successor of America's first central station, built under the personal direction of Thomas A. Edison at 257 Pearl street, New York city, in 1882.

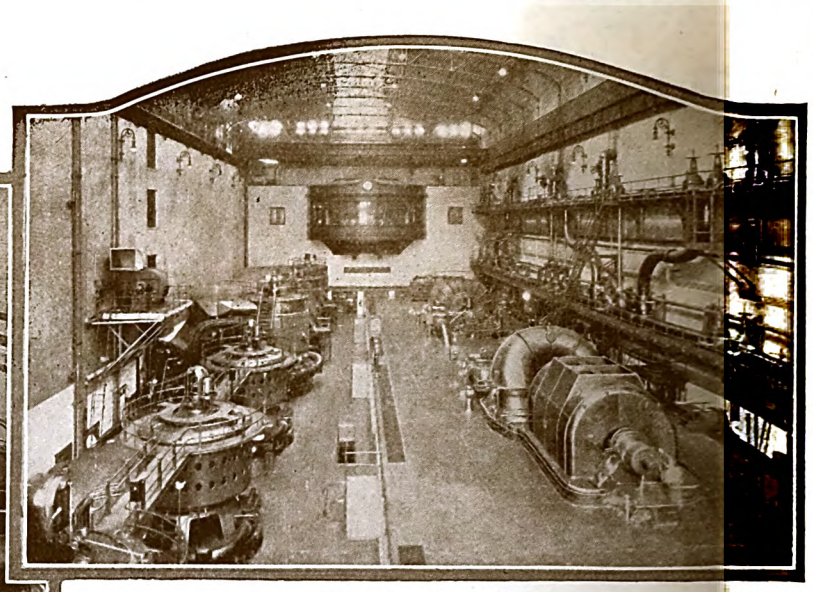
Twelve mines send the coal required to feed the furnaces at Waterside. Some of it, 2,500 tons to be exact, is delivered daily direct to the power plant and stored in concrete bunkers above the furnaces; the excess is stored on a 25-acre tract at Shadyside, N. J. on the Hudson River opposite 112th street, whence it is delivered by barges to the various generating stations of The New York Edison system, all of which are on the river front.

Half a million tons of coal pass through the storage yard at Shadyside each year; approximately 200,000 tons are on hand there at all times, and

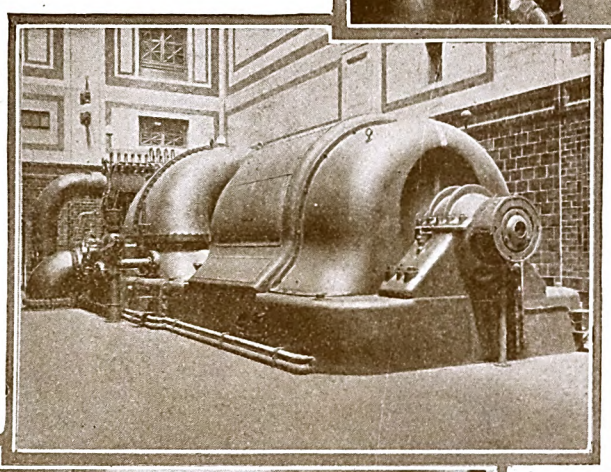
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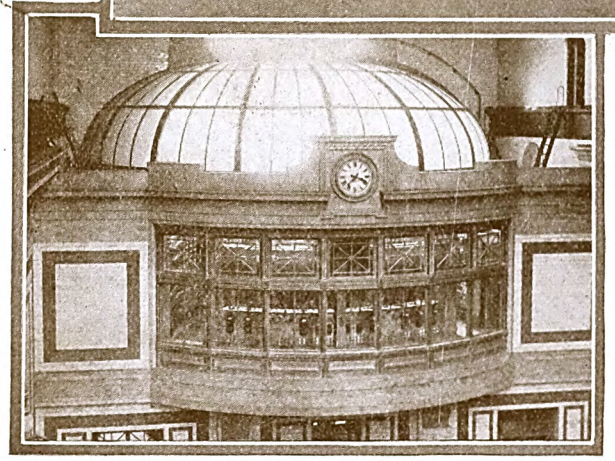
The generating room of Waterside No. 2. These two rooms, which are operated as a unit, probably constitute the largest turbine-generator battery in the country, the twenty generators in the two rooms, having a capacity of 324,000 kilowatts.



The turbine generator room at Waterside No. 1. Cables conduct the current from the generators, through reactors, oil switches, and buses, to the distributing stations about the city. The operation of this room is directed from the balcony extending into the room on the far wall.



A close-up of the machine which creates electrical energy and starts it on its journey on the wire, one of two 35,000 kilowatt horizontal turbine generators at Waterside.

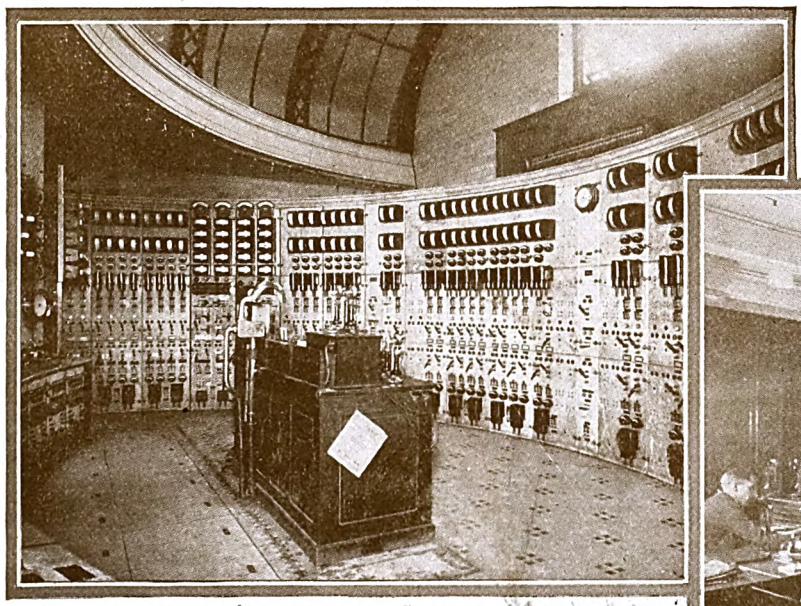


Close-up of the gallery from which the operation of the generating room is directed, and below, inside this gallery.



How many thousand kilowatts of electric energy do the lights in these buildings in lower Manhattan represent?

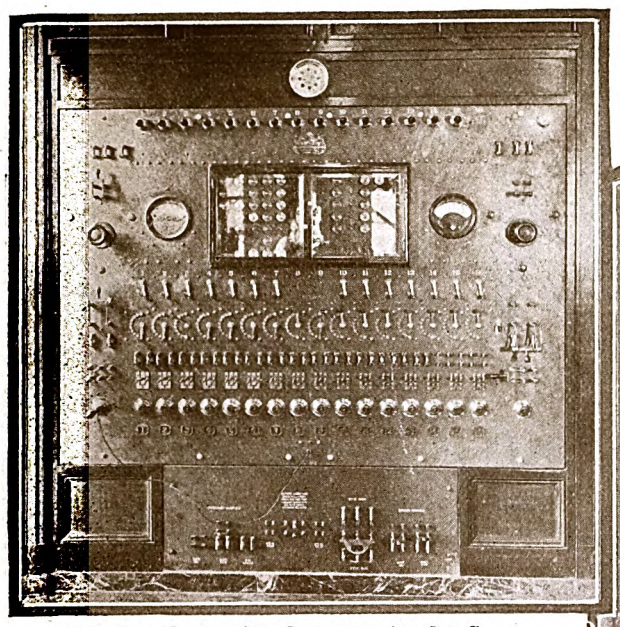
25,000 tons are always on the dock ready to be rushed to the generating stations in an emergency. With two pieces of equipment on the dock, a bridge tramway and a hoisting tower, Shadyside can load or unload 2,500 tons in ten hours. Two 100-foot locomotive cranes and a cable car system of 21 three-ton cars complete the mechanical equipment of the yard. A force of less than 40 men receive and ship the 500,000 tons of fuel turned over annually at this yard, and the six mountains of coal in this yard are almost entirely free of the spontaneous combustion smoulderings common to such quantities of bituminous. If you ask old George McKnight, superintendent at Shadyside, how he accounts for this, he will answer in one word: "Experience." Then he will go on to tell you that he has seven men there today who were there when he came to Shady-

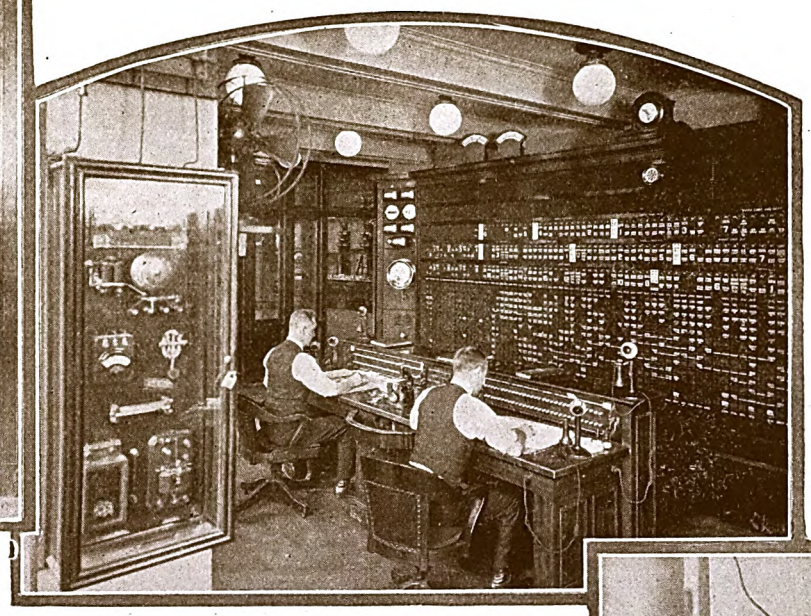




The nerve center of the entire New York Edison system. The condition of every boiler room, every generator, and every distribution line, is indicated on the System Operator's board. Direct telephone connection with eighty men through the switchboard on his desk, and a fire alarm signal system at his right gives the system operator a means of instantaneous communication with any one or all his stations. A wireless storm detector behind him warns him of approaching storms and darkness an hour or more before the clouds have reached New York City.

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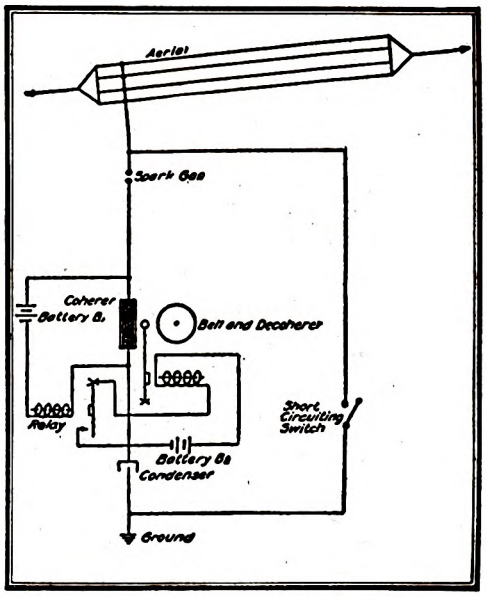
The fire-alarm signal system in the System Operator's room at Waterside which enables him to send any one of several score messages to any group of four stations or all the stations on the system.

Two forms of storm detectors in use at Waterside. When a storm is brewing anywhere in the vicinity of New York City the bell on the storm detector warns the system operator of the approach of clouds by ringing at the rate of, perhaps, once every minute or half minute; as the storm gets closer to New York the bell of the storm detector rings at shorter intervals. Prior to the installation of this device it was customary at Waterside to have a man stationed on the roof of the building almost constantly during the day on the lookout for dark clouds.

side 19 years ago, and that there is not a man in the yards who has been there less than three years. But we must get back to the actual process of putting coal on the wire.

The raw material of the central station is delivered to Waterside in barges carrying 800 to 1,500 tons each. Three buckets, each taking a ton and a half at a bite, hoist the coal 180 feet above the water, swing it into the coal tower, and empty it into hoppers leading to the crushers. The buckets make the 180 foot trip in 30 seconds. As quickly as the coal is dropped into the tower it is, in one continuous process, pulverized, loaded into cable cars, weighed, started on a circuit of the building over the bunkers, and at intervals along the track dropped into the bunkers by automatic trips. It requires only six men to transfer 2,500 tons of coal from the

(*Continued on page 41*)



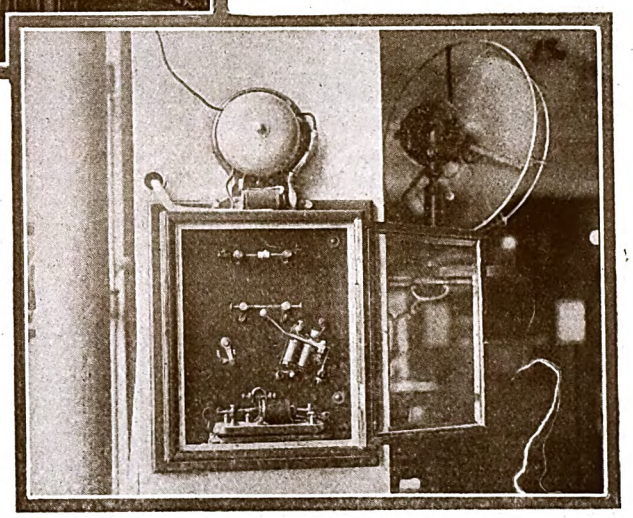
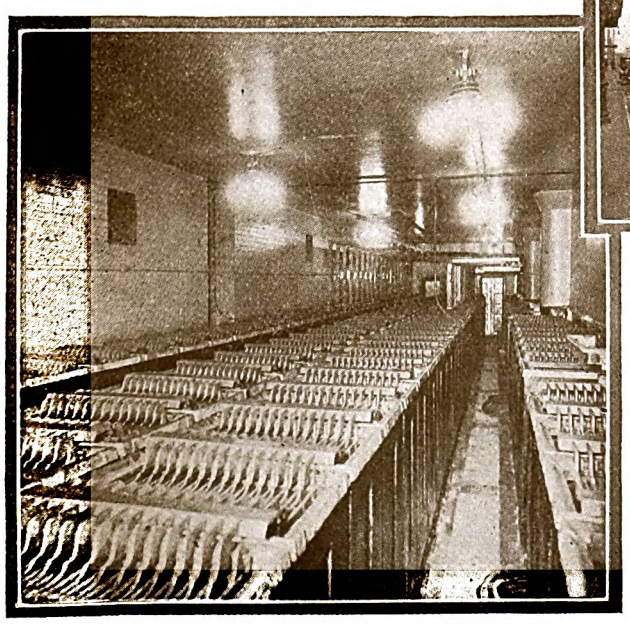


Diagram of the construction of the wireless storm detector. Since electrical energy cannot be stored in any large quantities, the central station—if it is to be operated at all efficiently—must vary its production of current as directly and as quickly as the demand for current varies.



The sub-station receives the current from the generating station in the form of alternating current of 6600 or 11,000 volts; it transforms this into direct and in some districts into alternating current of 120 volts and distributes this to the network of underground feeder boxes.



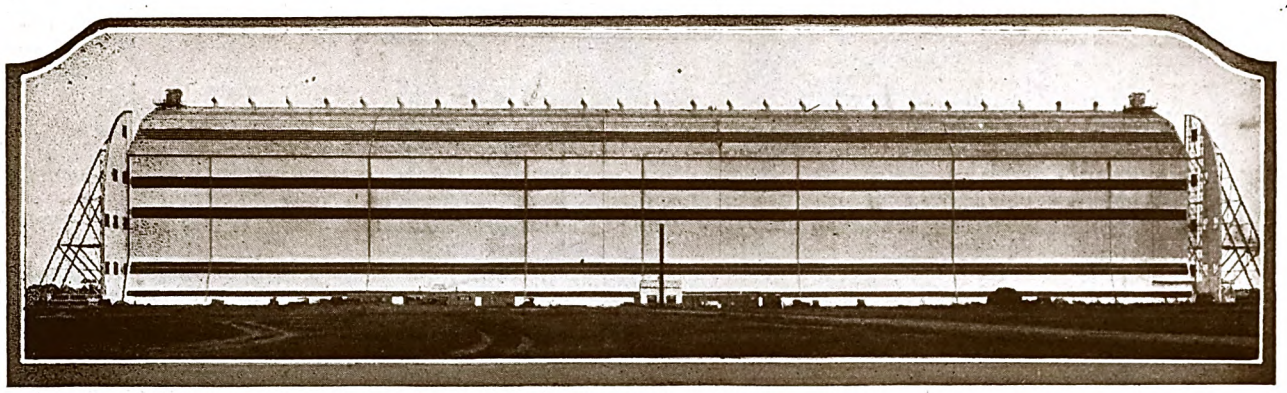
One of several storage battery rooms in each sub-station of The New York Edison Company, at the left. These batteries could carry the entire load of the sub-stations for a period of five to seven minutes, though the emergencies for which they are provided rarely last more than a minute.



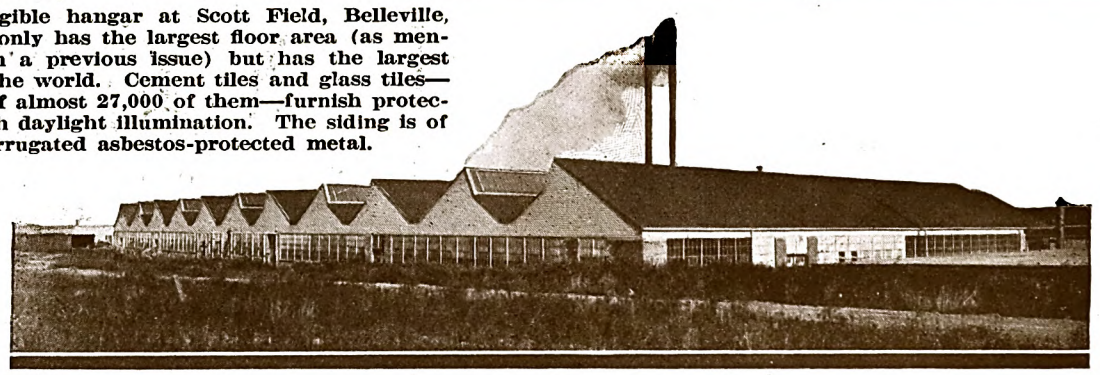
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Roofing the Old and the New Buildings

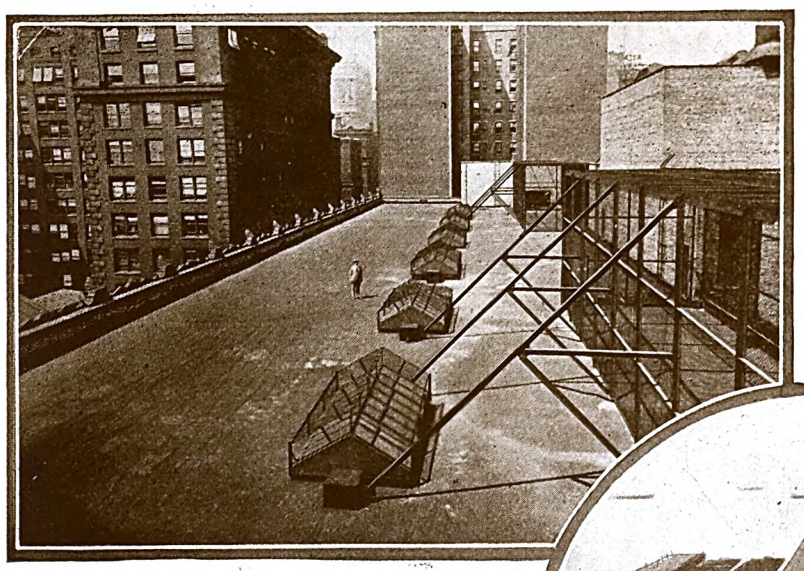
By W. Thomson Lees



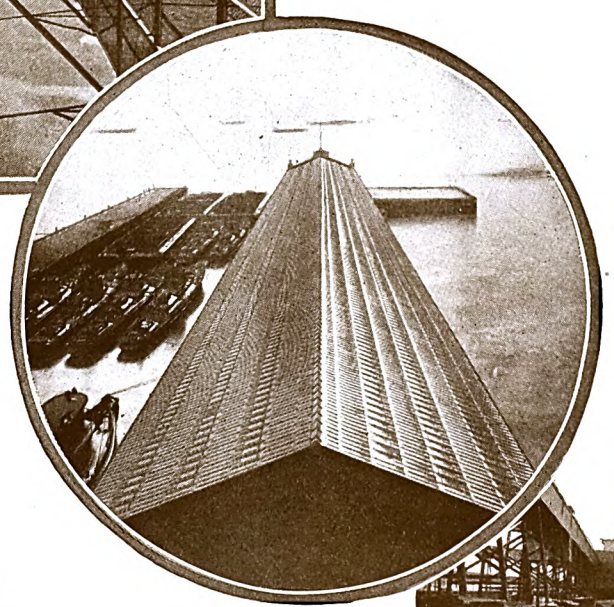
The dirigible hangar at Scott Field, Belleville, Ill., not only has the largest floor area (as mentioned in a previous issue) but has the largest roof in the world. Cement tiles and glass tiles—a total of almost 27,000 of them—furnish protection, with daylight illumination. The siding is of corrugated asbestos-protected metal.



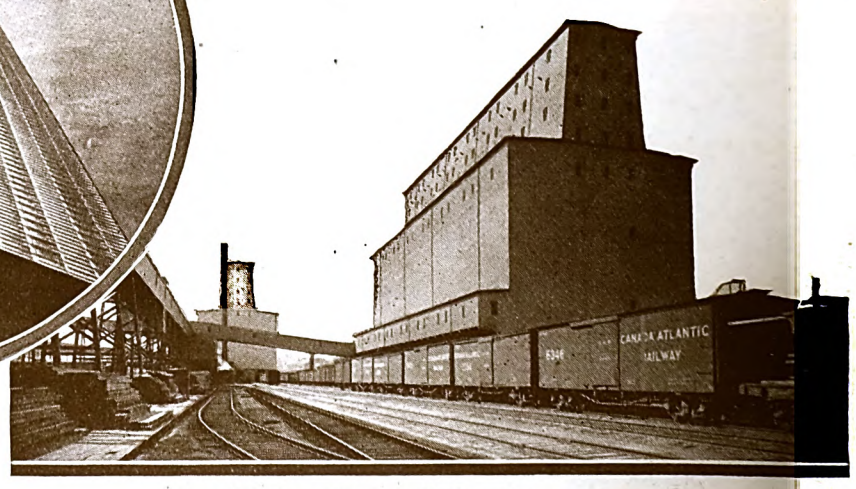
Above is an example of asbestos roofing of the ready-to-lay type, slate surfaced, as used on a group of Cleveland Tractor Co. buildings. This makes a durable, neat, easily applied roofing for buildings of this type.



Where large flat areas are exposed to smoke and acid fumes and severe service, the "built-up" type of roofing, with asbestos and asphalt, is probably the nearest approach to permanent weather protection; an example being the Chicago Western Union Building, above.



In the circle is one of the E. W. Bliss Co. buildings, exposed to marine atmosphere, and roofed with cement tiles; not only architecturally beautiful, but unaffected by fumes or climate, and therefore particularly adapted to the purpose.



The old-time "tin roof" has by no means gone into the discard; as witness this grain elevator of the Grand Trunk Railway, Portland, Me. Sheet metal roofing, today, has the benefit of much research in the production of durable sheets of uniform quality.

We install a machine, and give it constant attention and inspection; we install a concrete, or wood block, or some other type of floor, and because this floor is constantly under observation, it is kept in a fair state of repair. But, in most industrial plants, when we install the roof we immediately proceed to forget about it. And that is one of the chief things contributing to the high cost of roof maintenance. That, and one other thing:—A very general lack of knowledge of roofing characteristics on the part of the average plant manager.

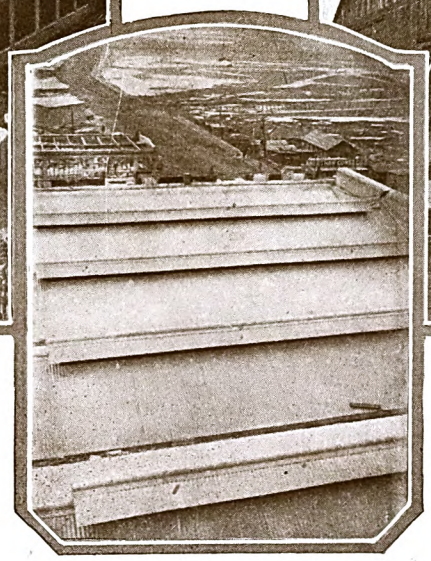
There is no such thing as a really permanent roof—one which can be installed and never thought of again during years and years. There is no such thing, either, as *one best roof* for every purpose. It is, however, possible to approach very closely the ideal of a "permanent" roof for any specific conditions of service. But whether this permanency lies with sheet metal, asbestos, concrete, asphalt, tile, or one of the many other materials available, is a matter depending upon these aforesaid specific conditions.

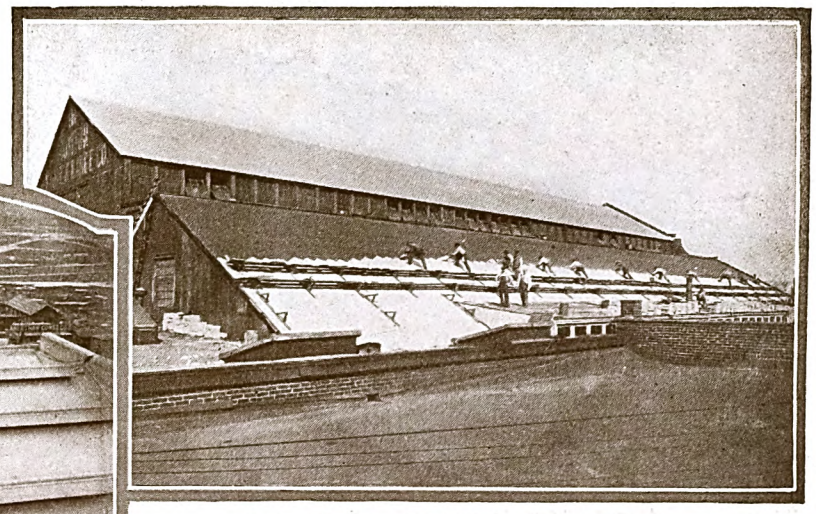
In the early days of industrial development in this country there were but three kinds of roofing in general use: The

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Another type of "ready-to-lay" asbestos roofing; made black on one side, white on the other, and which can be used either side to the weather. Here, at the plant of the Holt Mfg. Co., Peoria, Ill., the white surface makes a splendid light reflector on a saw-tooth roof.





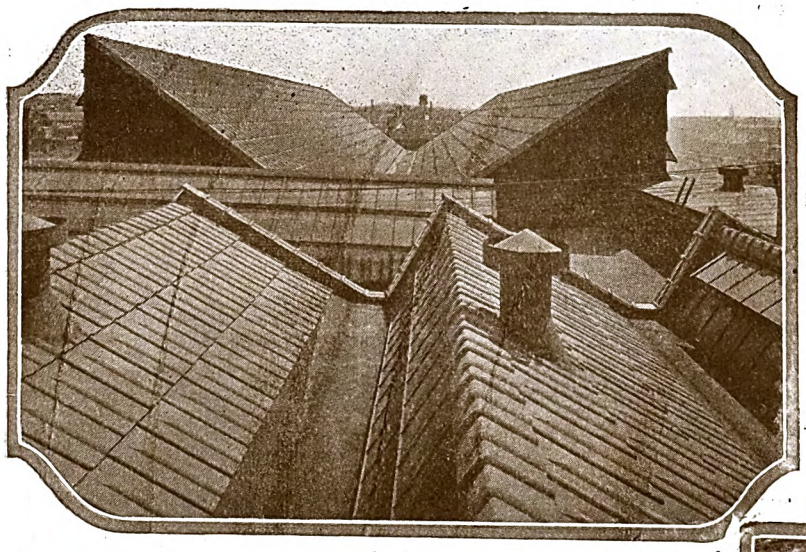
One of the advantages of asbestos shingles, is the ease with which they may be applied over old wooden shingles—as shown above at the Monitor Stove and Range Company's plant.

slate roof, the so-called "tin roof," which was really made of sheet iron or sheet steel, and wooden shingles. Tile roofs were little used, because of their relatively high cost.

We still find examples of all three of these types in use today; though the fire hazard is driving wooden shingles into the discard, as far as industrial buildings are concerned.

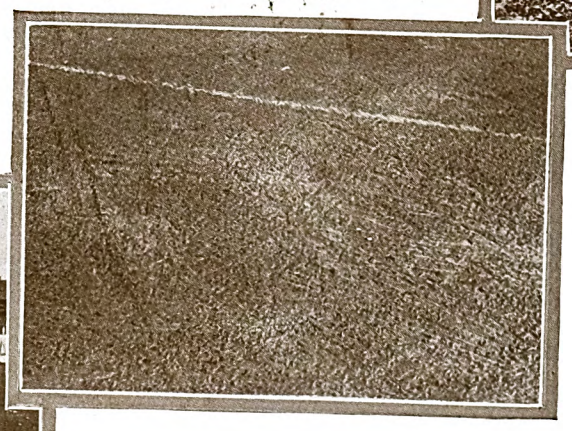
Each of the three original roofing materials had certain advantages to commend it. The wooden shingle was easy to apply, extremely light in weight, and could be installed and kept in repair by any average handy man. Today, doomed by its fire-inviting characteristics, the wooden shingle gives place to a host of different makes of "ready-to-lay" roofing. These modern successors to the light-weight, easily applied shingle of wood, run all the way from rolls of prepared felt (incorporating more or less asbestos and tar) to squares of varying sizes, individual asbestos-base shingles, and so on. The variety is so great that no one need

At the left is a sheet metal roof—so-called "tin" roof—on the Commonwealth Fish Pier, Boston, Mass. Note the ventilating provision at the ridge of each section.



Glazed cement tiles are not confined to piers and dirigible hangars, by any means. Here for instance, is an example of an attractive treatment of saw-tooth construction.



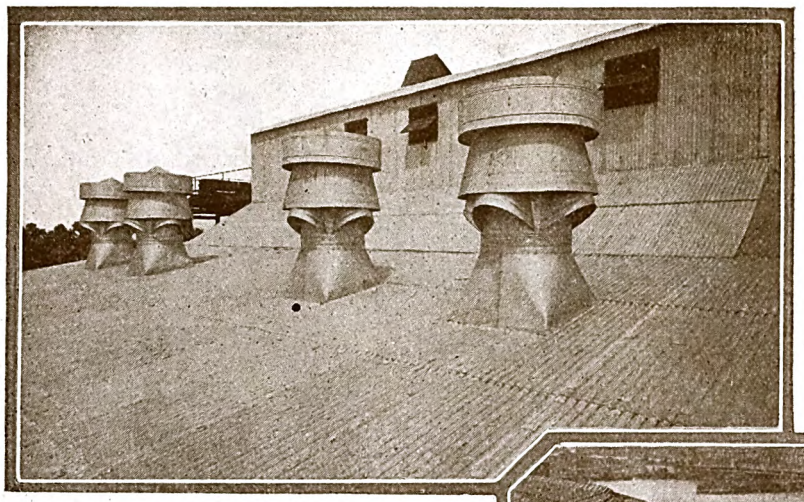


When a built-up roof begins to show bald spots, as above, the easiest way to remedy it is by applying a specially prepared liquid—which is brushed on—and the roof assumes the respectable appearance shown at the left. More important it is a permanent repair.

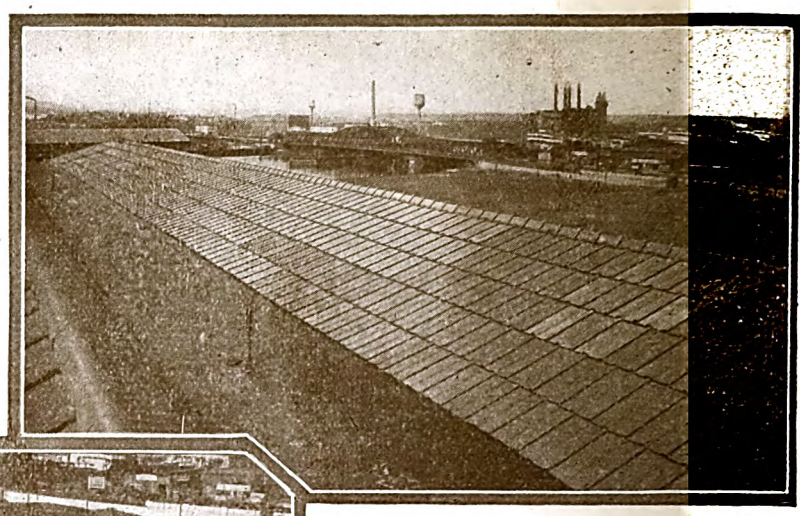


A feature of interest about the roof at the left (on the Monangah Glass Co. plant, Fairmount, West Va.), is that it requires neither paint nor gravel surfacing for protection—being made of natural asphalt. While not especially beautiful, such a roof resists both wear and the elements to a superlative degree.

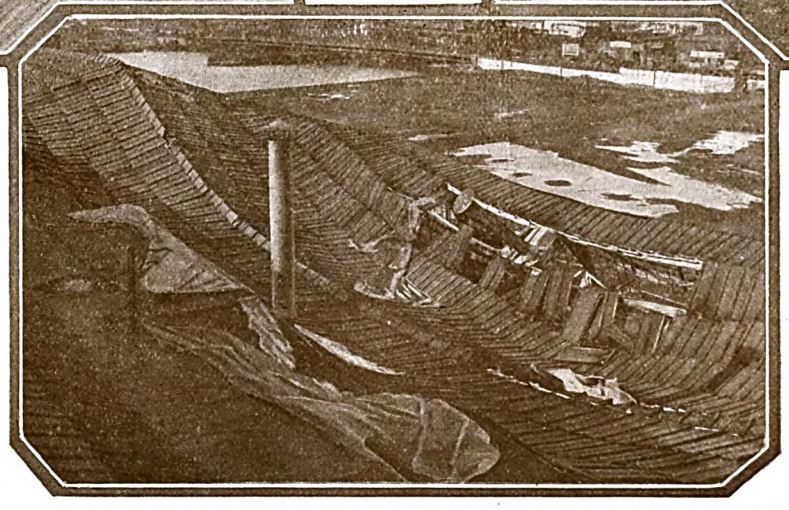
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Both roof and siding on this building of the Iowa Southern Utilities Co. are of corrugated asbestos composition—asbestos fibre and Portland cement, united under hydraulic pressure. Rot-proof, with nothing to rust or decay, its natural gray surface requires no painting or other protection.



Above is the same roof as shown at the left; reconstructed after the fire.



A fire at the Ford plant in Kearny, N. J., burned away the timbers, but it seems to have had little if any effect upon the cement tiles which comprised the roof itself.

mourn the wooden shingle for lack of substitute.

All of these prepared roofings have their uses, and generally speaking, all of them retain the advantage of lightness and ease of application. They range from the very lightweight, intended primarily for buildings of a temporary nature, up to material of sufficient thickness and surface protection to last for generations.

Sheet metal roofs — the standby of earlier days—fell into disrepute for a time. This was because when sheet metal was first made under quantity-production methods, the quality suffered. In later years, an immense amount of research has been done in this field, with the consequence that the sheet metal roof is once more taking its deserved place.

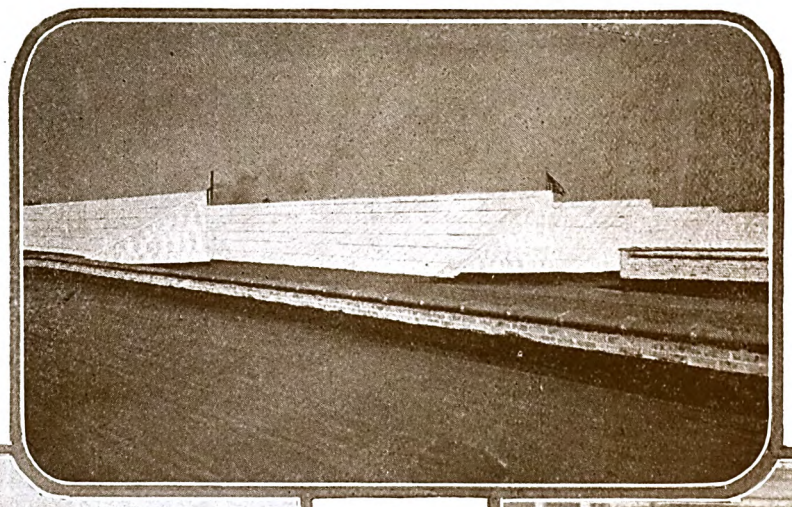
The forms in which galvanized sheet metal roofing is applied are many, including metal shingles, and metal Spanish tile. For industrial buildings, however, corrugated sheets are the most common form in use. Corrugated galvanized iron or steel sheets possess the advantages of great ease and simplicity of erection. They are comparatively light in weight and possess great lineal rigidity. In fact, except with light gauges, sheathing beneath such a roof is unnecessary. One and one-half corrugations side lap and from three to six inches end lap makes a good tight roof.

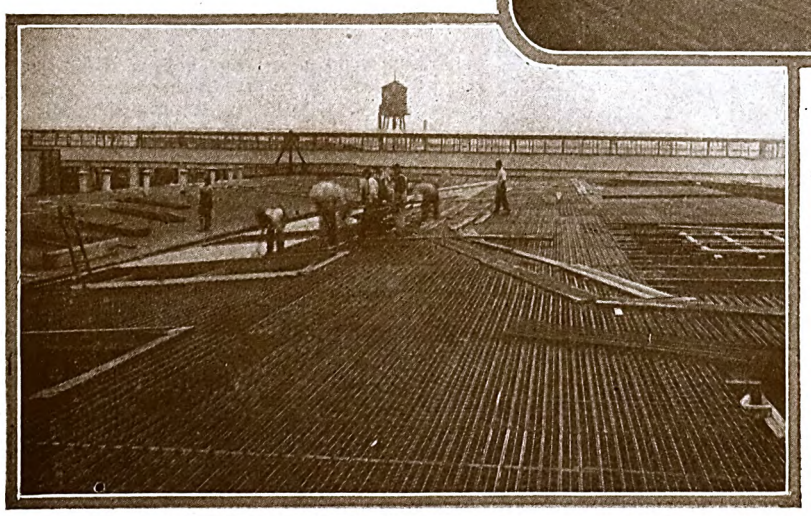
Good iron or steel of good weight properly coated with zinc, will give very satisfactory service. This zinc coating is applied by passing the carefully cleaned sheets through a tank of molten zinc and the zinc forms a thin coat which is a very real protection for the iron or steel base. The character of the metal under the zinc, however, is the big factor in the lasting qualities.

The proverbial "good sheet

(*Continued on page 70*)

Below—a combination of two types of asbestos roofing; built up asbestos felt and asphalt on the flat deck, and white-faced siding (for its light-reflecting qualities) on the saw-tooth structure.





The preliminary stage of constructing a concrete roof at the Elkhart Machine Co., Indiana; putting down the special steel ribs.



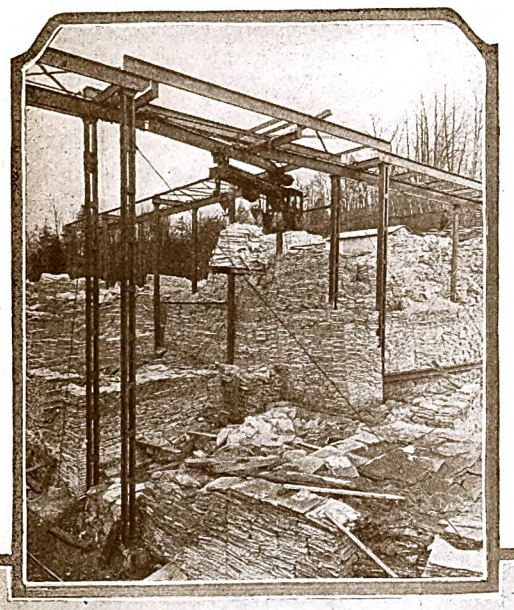
Applying concrete to the roof (shown in an earlier stage, at the left). The steel acts both as retaining form and as reinforcement.

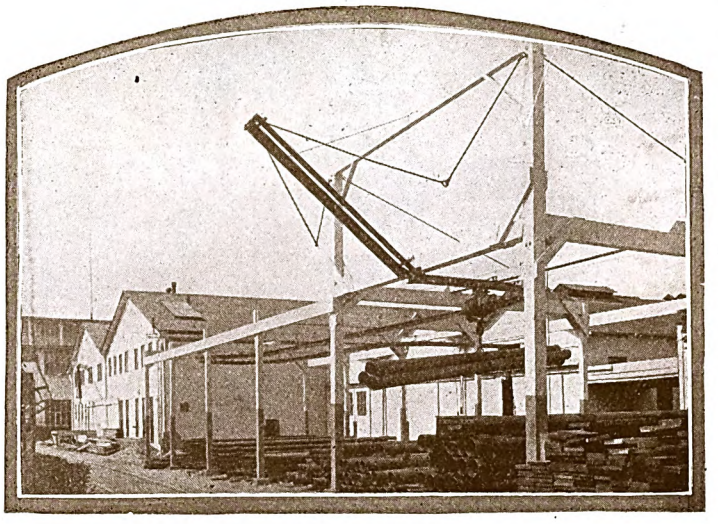
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Storing and Handling Materials in the Plant Yard

By John Herbert

In the yard of the Stevens-Thompson Paper Company, Greenwich, N. Y., this hoist carries pulp from mill to storage yard. It released five men when it replaced the wheelbarrow method.

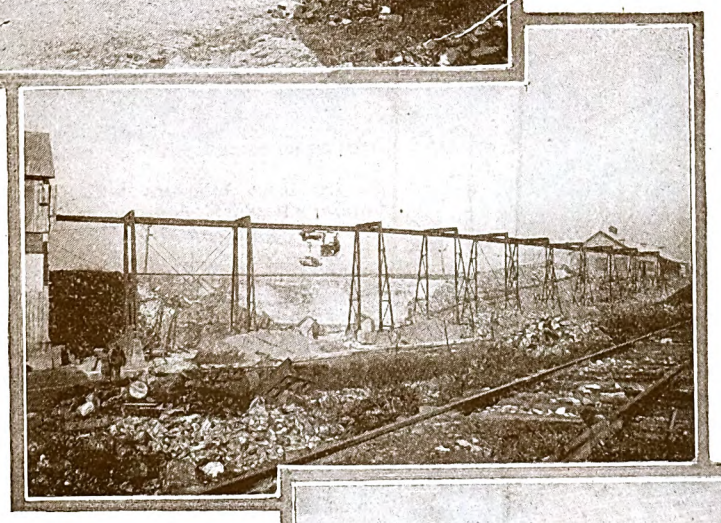




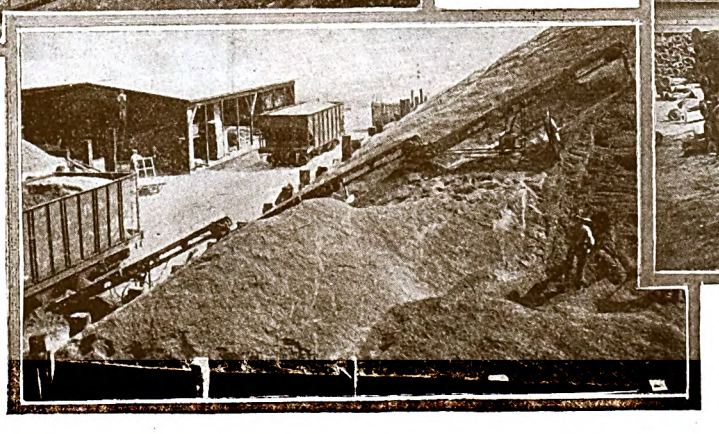
The economical handling of pipe is a problem in many plants. This is a very practical solution for that problem. It shows the practice at the Byron Jackson Iron Works, Berkeley, Calif.



Even brick are today handled automatically. This portable loading machine takes the place of a regiment of hod carriers and doesn't belong to the union.



A long ride for little money is being given to the ore contained in the bucket of the electric hoist, shown in the picture at the left, in the yards of E. J. Levin Company, of Plymouth Meeting, Pa.



It is not hard to move mountains today. This mountain of coal is being moved by the motor-driven portable conveyors which load, unload, or transfer at the will of the yard foreman.



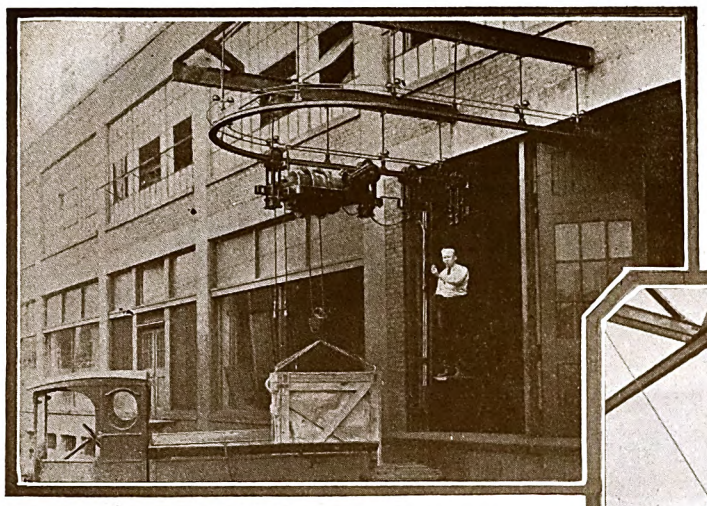
A somewhat unusual but quite practical and economical way of transporting and piling castings is here shown in which the electric tractor does both hauling and lifting.

THE modern plant or factory yard is not merely so much unoccupied land but a very important productive part of the "works." It is true that plant yards, so far as industrial history is concerned, extend back into the realms of antiquity, but the purposes that they fulfill today are entirely different from those that they served even ten years ago.

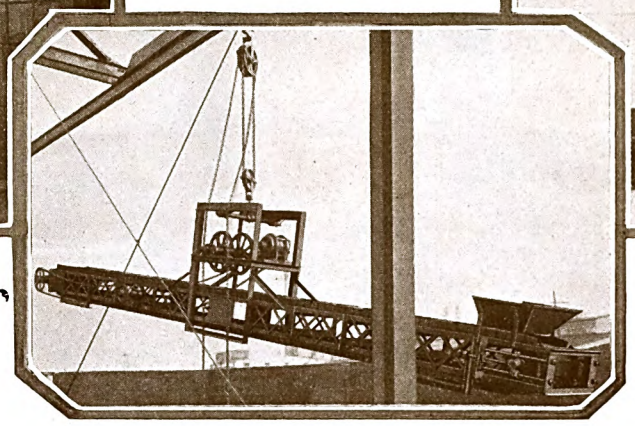
The old plant yard was merely a portion of ground not yet built upon. It was used as a place to dispose of things that one was not in a hurry for and that one did not consider sufficiently valuable to keep under the protection of a roof away from the exposure of the elements. Of course there were exceptions to this rule, not only in individual plants, but in the cases of certain materials. Coal, for example, has always been kept in the plant yard because that is usually the most convenient place to keep it.

But today the yard of the modern plant is much more than so much waste space or a mere junk pile or a catch-all for things that are conveniently forgotten. The plant yard is a real, a definite and a profitable manufacturing department—a part of the process, if you please. It has become so because of the remarkable

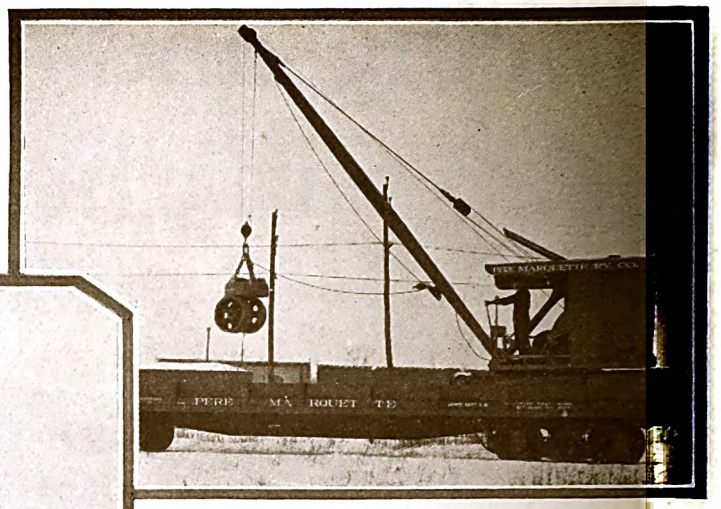
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Four men were formerly employed to unload at this factory door. Now the electric hoist mounted on the monorail replaces three of them.



An overhead slat conveyor which is suspended from a monorail and which handles coke from cars to storage bins.



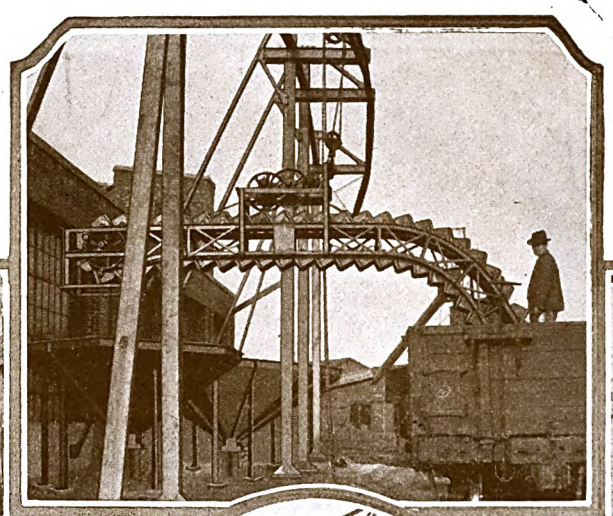
A novel job for an electric lifting magnet is that of hoisting the cast steel wheels shown in this picture. Very little contact surface is available.

development of materials handling apparatus.

With the exception of some plants located in cities or congested districts, where the land is worth as much or sometimes more than the buildings, the unbuilt-upon land adjoining the average plant is the least expensive part of it judged on a "square foot basis." Wise and far-seeing managers have taken advantage of this fact to enable the increase of production in their factories without running the danger of over-expansion through unwarranted building construction. They do this by thorough utilization of the plant yard, made possible by modern cranes, conveyors and tractors.

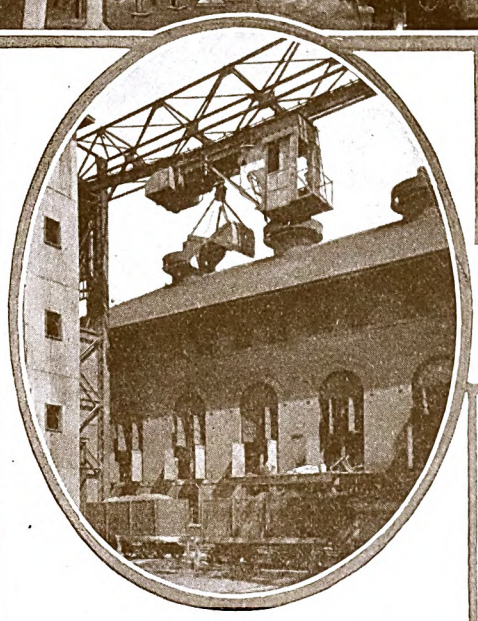
This proper utilization of yard space in connection with the full utilization of floor space in existing buildings will keep the investment in plant buildings down to a minimum, will decrease the manufacturing charge per square foot of floor space, lower the overhead

This Caterpillar type of bucket conveyor (below) is suspended from an overhead drag permitting the delivery of material into any one of the hoppers.

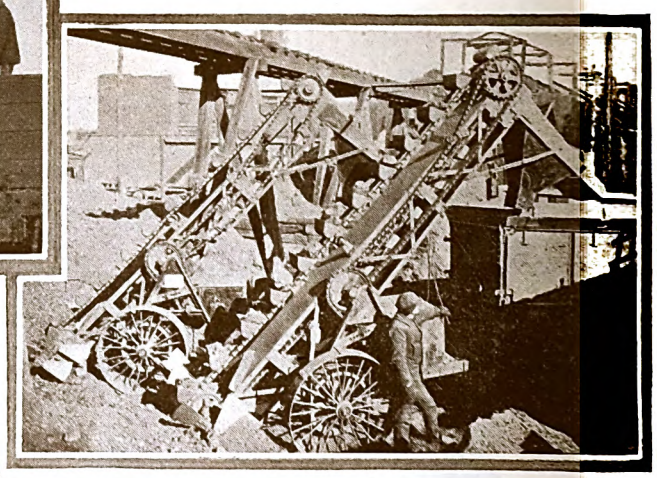




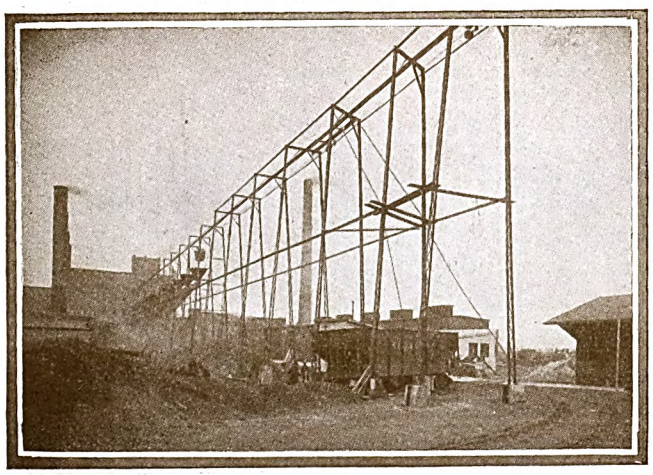
Dump cars have added range and flexibility when served by loaders such as this.



This three-ton hoist handles and mixes coke breeze and coal screenings at the rate of 50 tons an hour, delivering it to overhead bunkers in the power plant.



Before long laborers will forget how to handle shovels. Automatic loaders do the work so much more quickly and cheaply.

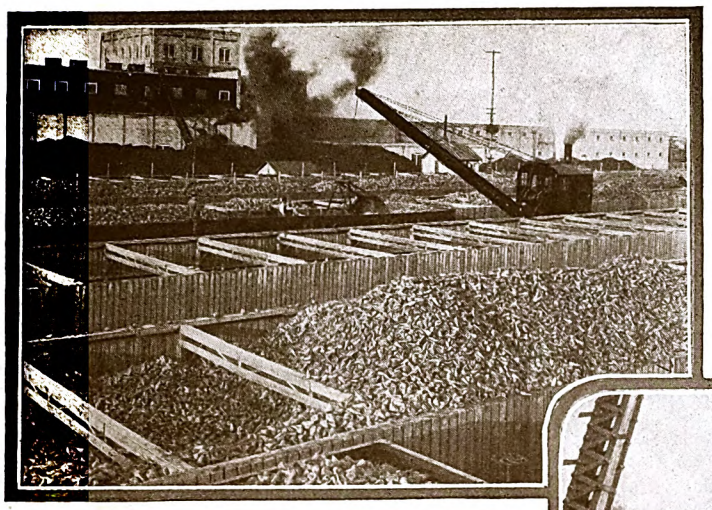


This overhead conveying system at the plant of the Columbia Stamping and Enameling Company is a means of delivering materials by hopper and chute to various locations as desired.

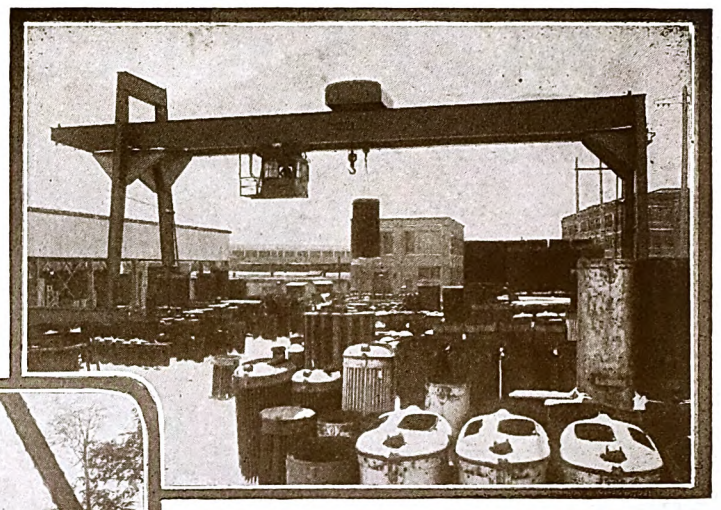


For storing and reclaiming large quantities of coal at low cost cable drag scraper systems have a number of advantages, particularly over the trestle method of dumping coal.

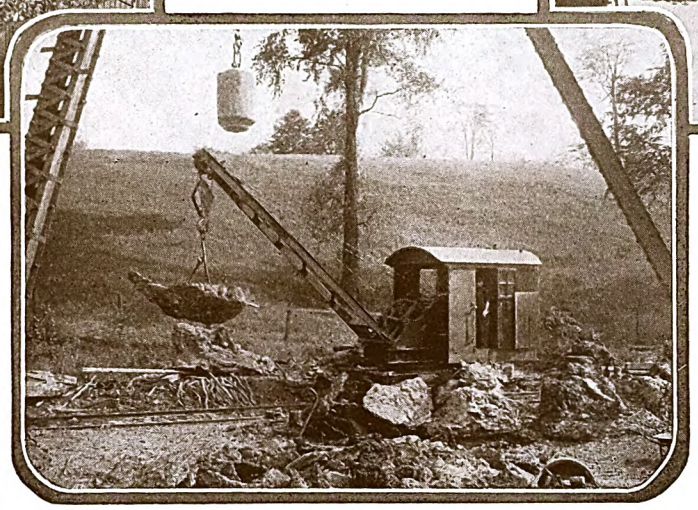
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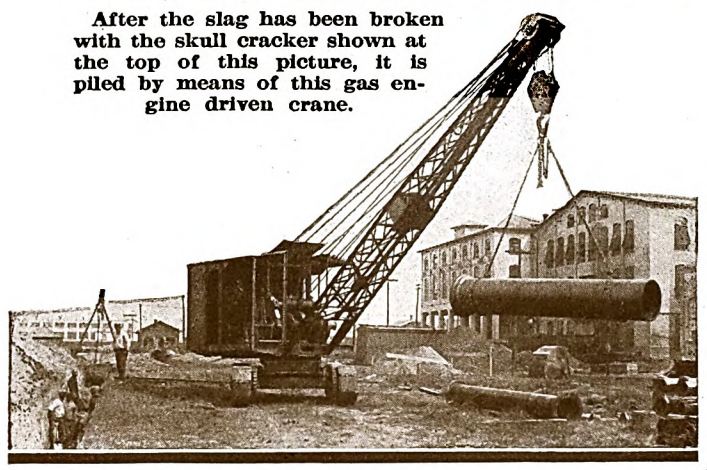
The piles of stock in the foreground look like coke but are, in reality, beets. One crane is transferring beets from car to pit, the other is transferring coal from pile to hopper.



Storage room under roof is not always necessary when you have a Gantry crane such as the above to run out into the yard and pick up what is needed.



After the slag has been broken with the skull cracker shown at the top of this picture, it is piled by means of this gas engine driven crane.



At the Kalamazoo Vegetable Parchment Company this crawler type crane excavates and handles pipe in connection with plant extensions.

percentage and reduce the cost of the product.

Many additions have been built to manufacturing departments that already have had more room than they needed. This was particularly true during the great boom of inflation when credit was easily obtained in unlimited amount. Hundreds of plants adopted hectic building programs to meet their apparent production requirements. As a result when the bottom dropped out of the inflated industrial structure these concerns found themselves with plants expanded to two or three times the normal requirements; and the excess capacity, not easily dispensed with, proved a serious liability, millstones in fact which pulled many a formerly sound company into the depths of financial troubles.

The first thing to do when it appears that the present factory buildings are becoming outgrown is to analyze the situation under two heads; first, how much space is being wasted in existing buildings under the present order and, second, how much of the industrial activities or functions can be cared for in the plant yard.

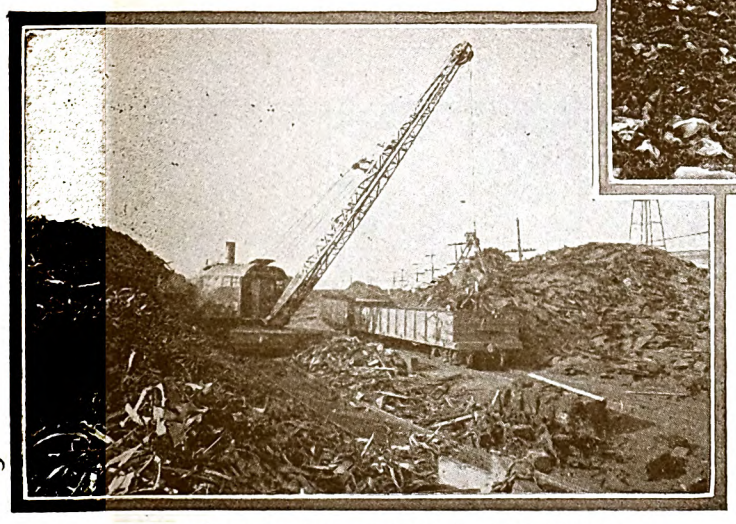
There are certain activities, of course, that must be carried out inside of a building. Workers must be protected against the cold that is experienced during winter seasons. Expensive tool equipment and semi-finished or finished stock cannot be exposed to the elements. On the other hand there are certain matters that can be cared for without inclosures or possibly with compromises in the form of roof shelters or platforms. One never has a very definite idea about these things until he stops to analyze the contents of one of his factory buildings.

In making such an analysis the first step is to analyze the functions carried out in a given building with respect to three requirements, as follows: First, the activities requiring full inclosure and heat; second, the activities requiring protec-

(Continued on page 63)



There is always opportunity to make new land around the big manufacturing plant. This overhead system does it as part of the day's work.



The crab bucket operated by this locomotive crane picks up huge bites of scrap iron, thus giving the lifting magnet "a run for its money."



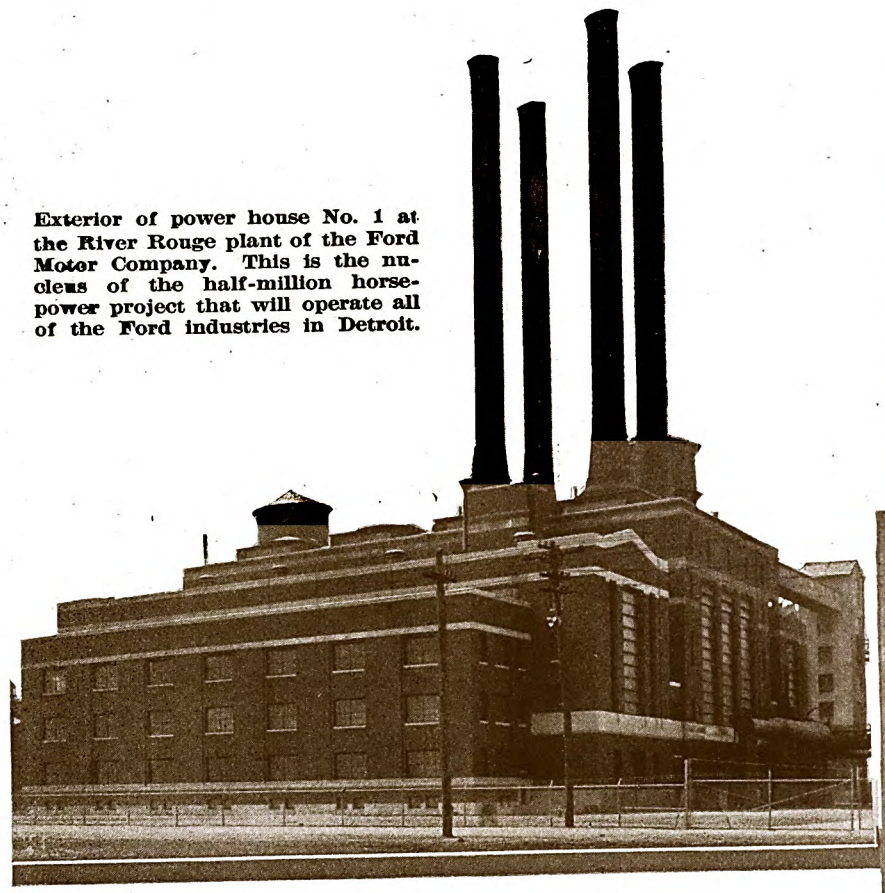
The motor truck has a place in hauling coal from storage but for most efficient service must be served by a coal loader.

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Power Generation at River Rouge

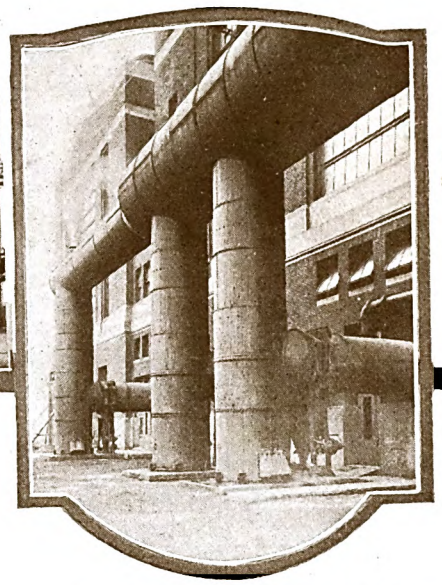
Converting Waste into Kilowatts at Ford's Newest Plant

BY JOHN H. VAN DEVENTER



Exterior of power house No. 1 at the River Rouge plant of the Ford Motor Company. This is the nucleus of the half-million horsepower project that will operate all of the Ford industries in Detroit.

IN spite of the ninety thousand men who are daily employed by the Ford industries in Detroit, power is the invisible workman who does most of the physical labor in the making of Ford car or Fordson tractor. From the ore and coal pile in the huge concrete bins back of the High Line at River Rouge to the shipping door at Highland Park, where the freight cars emerge with finished product, *power* does all the hard work of pulling and pushing, lifting and hauling, picking up and setting down, boring and turning, sewing and stitching, planing and polishing—in fact power, under man's supervision, creates the five thousand cars and the five hundred tractors that comprise the present time daily Ford output.

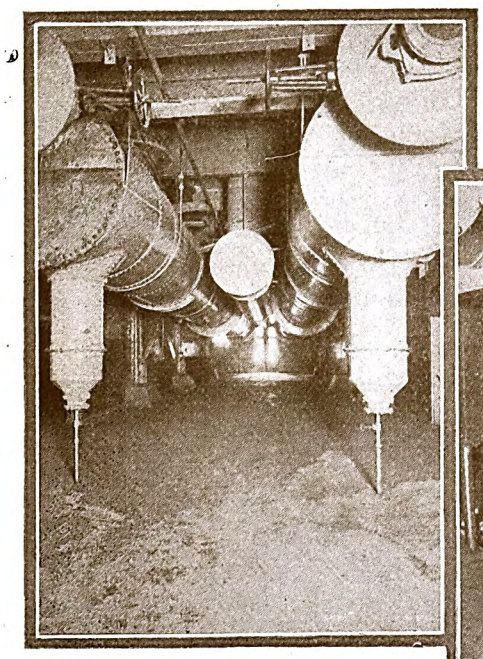


Seventy per cent of the fuel used for power is waste gas from the blast furnaces which comes to the power house through the huge mains shown above.

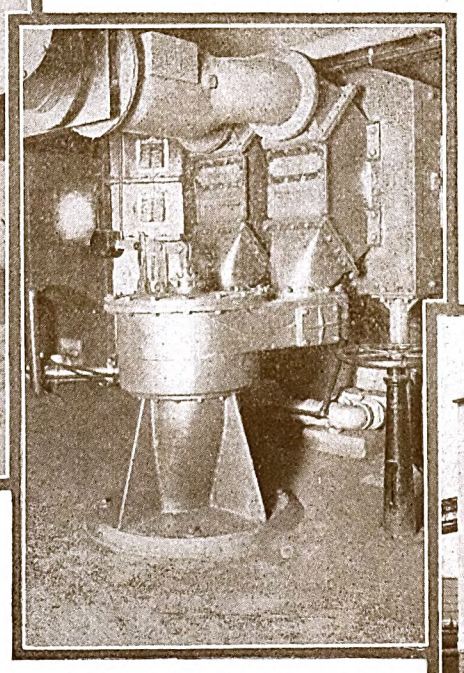
One who has followed the preceding pictorial articles in this magazine* which have illustrated other departments of the highly interesting River Rouge plant at Dearborn, Mich., will have noted the many unusual ways in which wastes are being turned into profits. Nowhere is this more true than in the huge "power plant No. 1," the great red brick and structural steel building from the roof of which giant stacks rise to a height of 320 feet, a building which house the 30,000 kw. nucleus of what is soon to be a quarter-million horsepower plant. For when the new construction now under way is completed, this *power* plant at River Rouge will operate all the Ford industries at Detroit, including Highland Park.

The exterior of this power plant is shown in the first picture accompanying this article. The building which extends some 350 feet from east to west 250 feet to north and south is divided into a number of rooms by vertical partitions or walls. These rooms are large enough to be buildings themselves and are actually

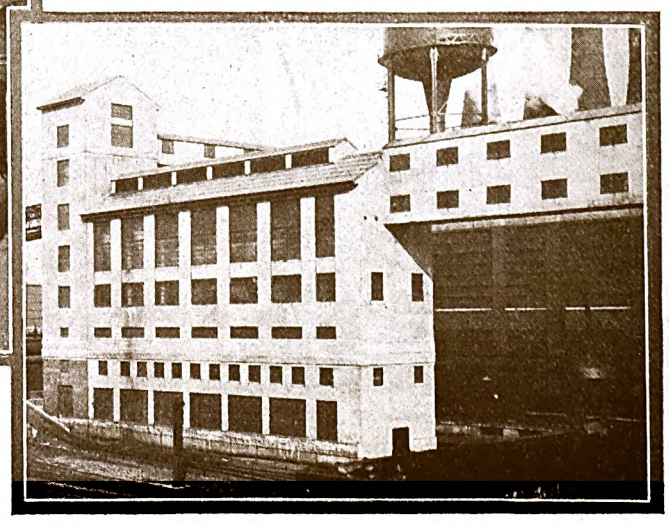
* See Industry Illustrated, November, 1922, and January, 1923.



Above is a view showing the blast furnace gas mains as they enter the ground floor of the boiler room under the huge water tube boilers.

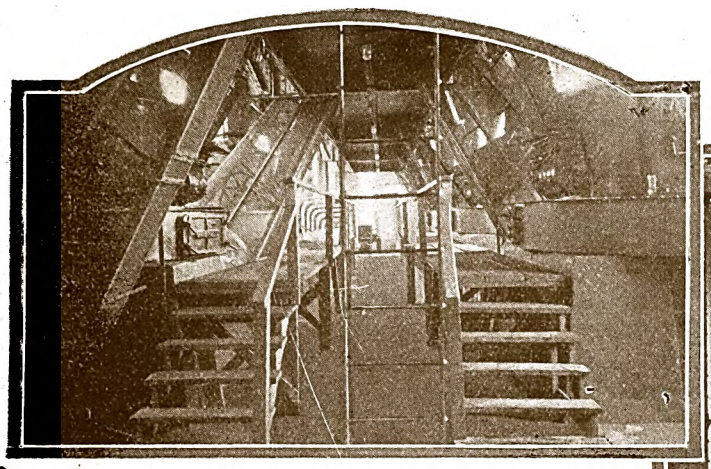


On the next floor above are the gas "burners" or mixers where gas is introduced into the combustion chambers through "Dutch ovens."

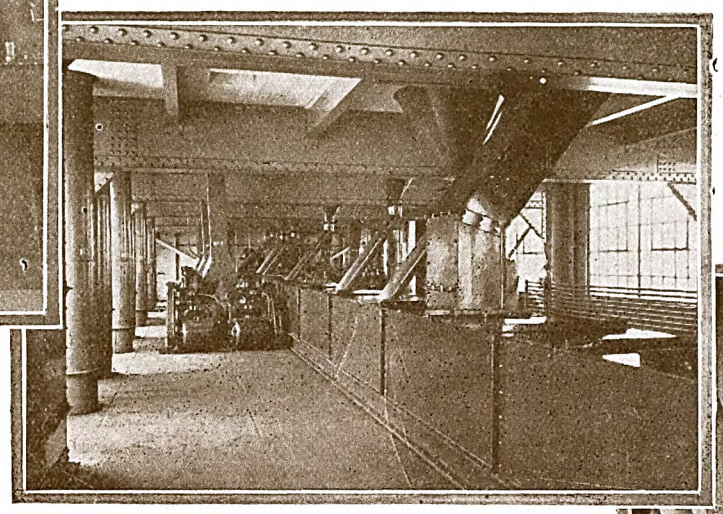


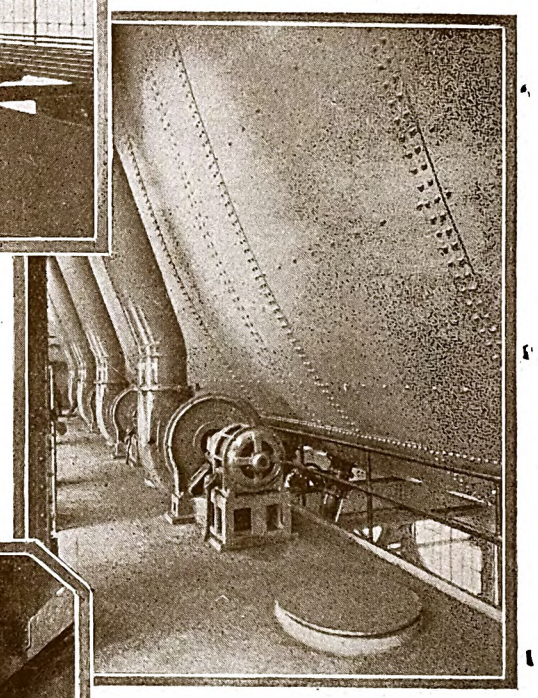
The remainder of the fuel requirements is normally cared for by powdered coal. This is a view of the pulverizer building which is connected to the power house by an overhead conveyor gallery.

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On the ground floor of the pulverizer building are two batteries of pulverizing mills which reduce nut and slack to extremely fine powder.





A system of cross conveyors distribute the raw coal to the bunker and the finished powdered coal to bucket flight elevators.

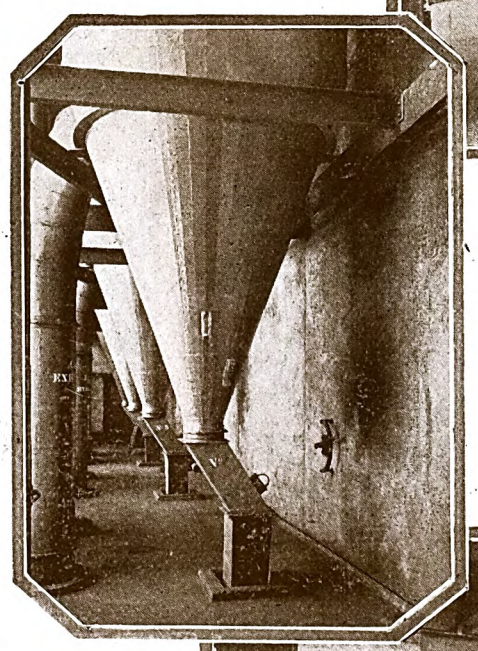
called "houses" in the plant parlance.

For example, at the extreme left in the picture is the "blower houses" in which huge multi-stage turbine driven centrifugal blowers provide air blast for the blast furnaces. Next to this is the boiler house containing at present four enormous water tube boilers rated at 2647 normal horsepower each. Three of these boilers are in operation at one time at present, working under an average rating of 250 per cent. Four more of them are now being installed, the work being well under way, for it must be kept in mind that there is nothing stationary about any part of the Ford industrial projects—they grow continuously and the power plant must not only keep pace with this growth but be, at all times, one step in advance of it.

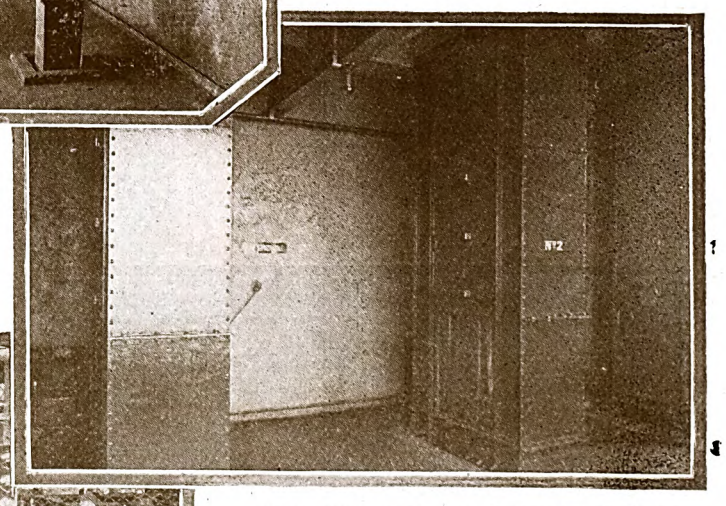
At the right of the "boiler house" is the "generator house." This is divided into two floors, the upper containing the turbine driven generators and the lower being in the nature of a condenser pit for the surface condensers and their auxiliary equipment which serve the huge turbines.

At the right of the generator house is the switch house which contains the electrical control and distribution system. This is divided into several floors on which are located switch room, reactor room, battery room, etc. This completes roughly the general description of power house arrangements.

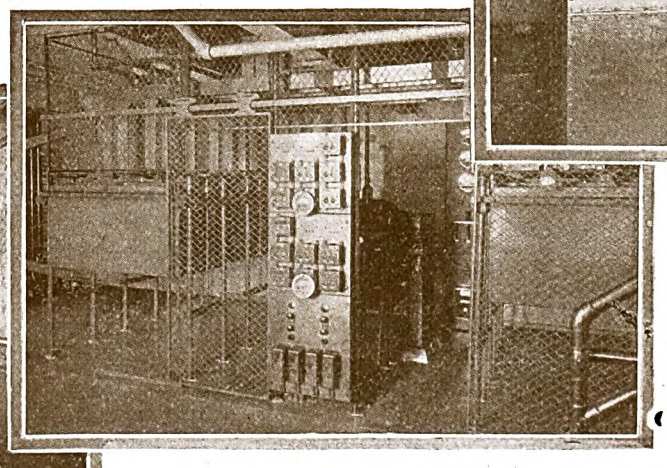
Any power plant may be regarded as a factory whose product is steam or electrical horsepower. A plant of this sort operates upon raw materials, the two principal ones being *fuel* and *water*. The by-products produced by such a plant are represented in the exhaust steam with its contents of valuable heat units. The efficiency of a plant of this sort does not depend merely upon how many pounds of fuel it requires to produce a certain number of steam or electrical horsepower. That is the small end of the problem.



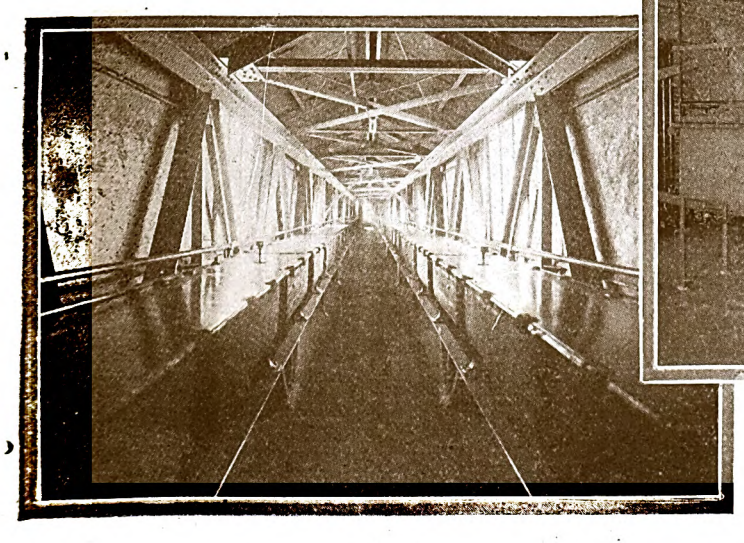
Above is a view of the 700-ton capacity raw coal bunker, from which the pulverizers are fed. The fans exhaust air from the pulverizers and deliver the powdered coal to cyclone separators shown at the left.



After the coal has been freed from the air it is carried by bucket flight elevators shown above to the top of the pulverizer building.

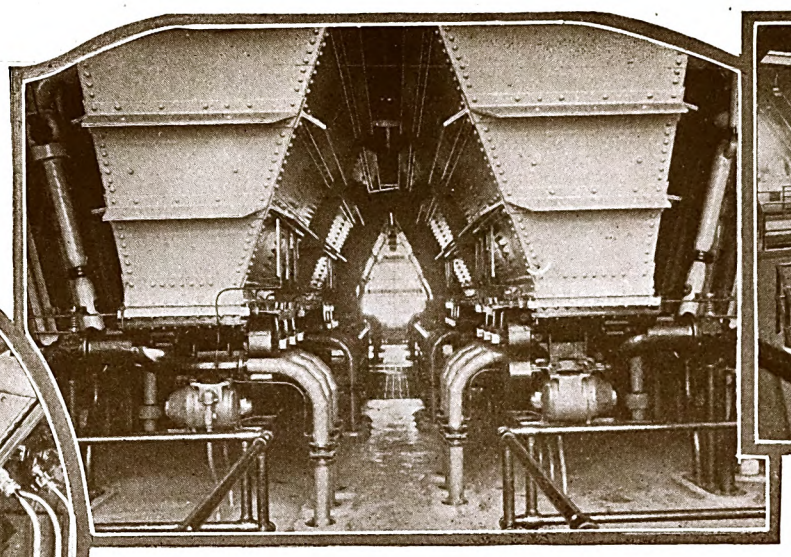


All of the conveyors and apparatus in the pulverizer building are under centralized push button control from the control room shown at the left.



At the left is a view of the conveyor gallery showing the two 16-inch spiral conveyors which carry the powdered coal across to the power house.

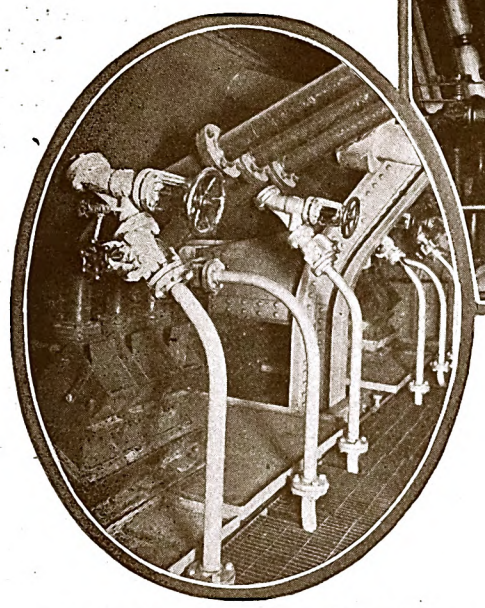
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Pulverized coal is stored in bunkers near the top of the boilers and is fed at any desired rate by means of coarse pitch feeding screws operated by variable speed motors.



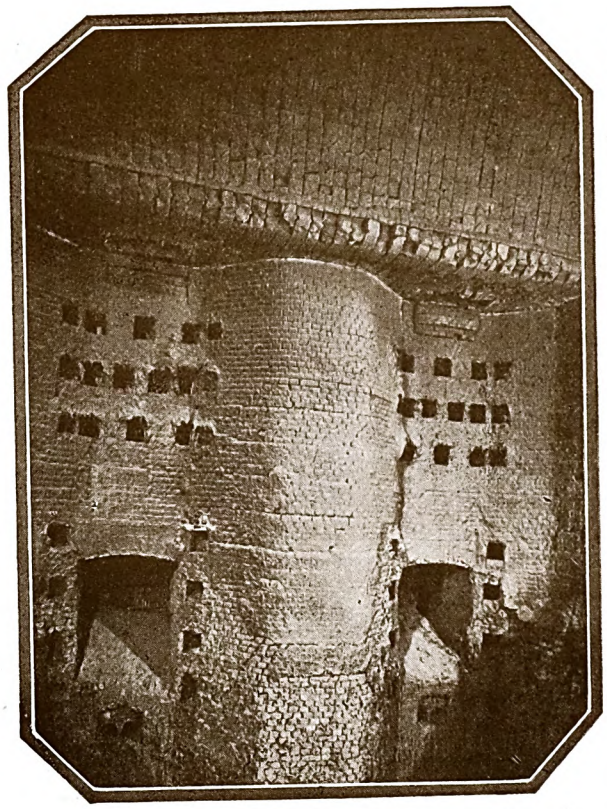
Spiral conveyors deliver the coal to the boiler bunkers, it first being automatically weighed by means of the scale shown in this picture.



After leaving the mixers the pulverized coal enters the furnace combustion chamber through burners shown above.



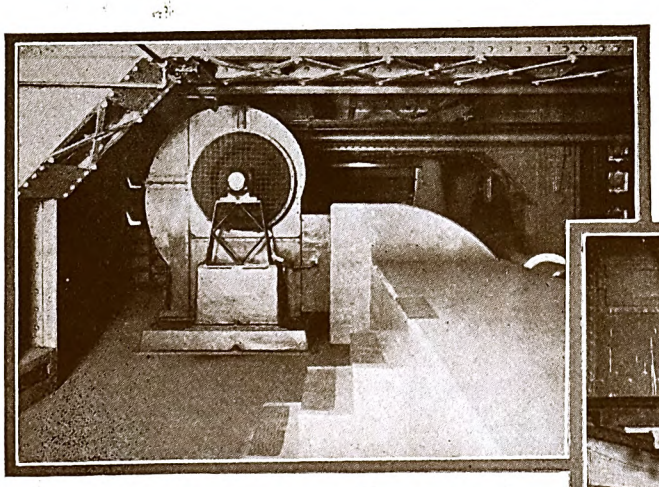
Ninety per cent of the air for combustion is admitted to the boilers by induction through hinged inlet doors such as shown in this picture.



This is not a picture of Aztec cliff dwelling but the interior of one of the huge combustion chambers of the boilers at River Rouge.

The big considerations in the case of a plant such as River Rouge are entirely different. The first consideration is continuity of operation—absence of shutdowns, even momentary ones, which would aggregate thousands of dollars in production penalties. The second consideration is the cost of the fuel. The average plant has little choice in this matter, having to pay what the coal dealer asks.

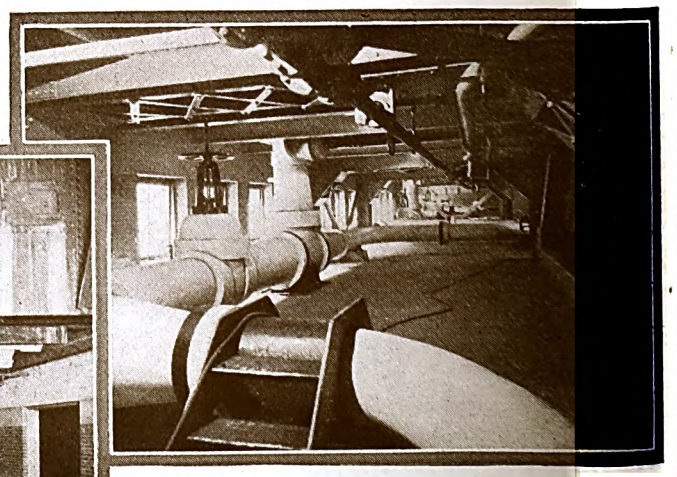
At River Rouge, however, the coal dealer plays but a small part. Seventy per cent of the fuel burned at River Rouge for producing power is waste gas which comes from the stacks of the blast furnaces. The remaining thirty per cent is made up of powdered coal. This fuel takes care of the fluctuations in rate combustion occasioned by varying the load, the flow of gas being practically constant, and all of the waste gas being burned. Provisions are also made to burn the coal tar and illuminating gas produced as by-products of the Ford coke ovens, if the emergency should demand. Means are also pro-



Motor-driven blowers, such as are shown here, furnish air to the powdered coal mixers shown at the top of this page.

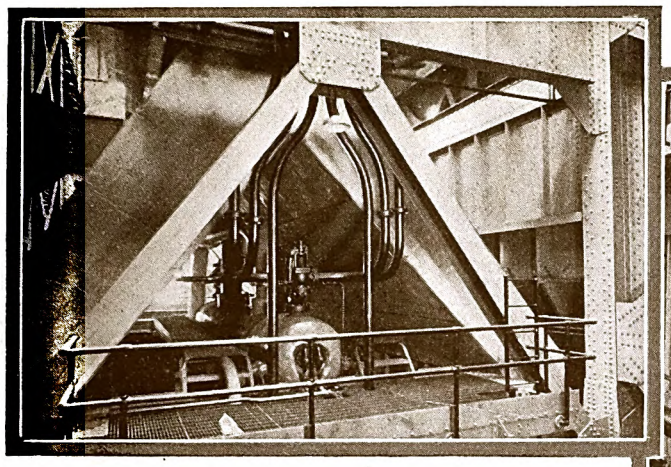
Below are the ash pit gates beneath one of the boilers. These discharge directly into freight cars on a track beneath.



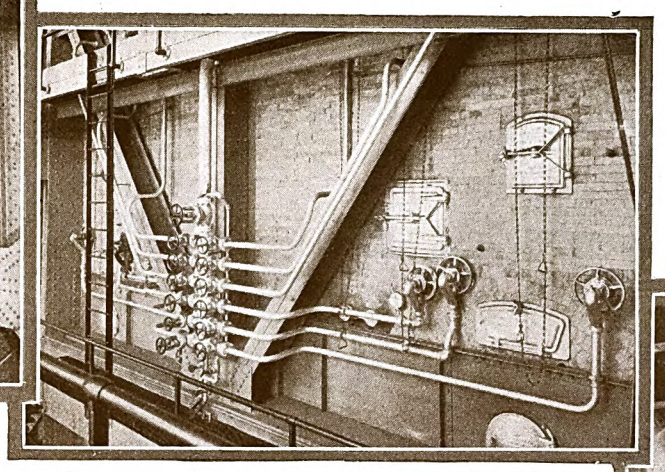


Steam from the boilers comes through vertical mains to a continuous header from which it is distributed.

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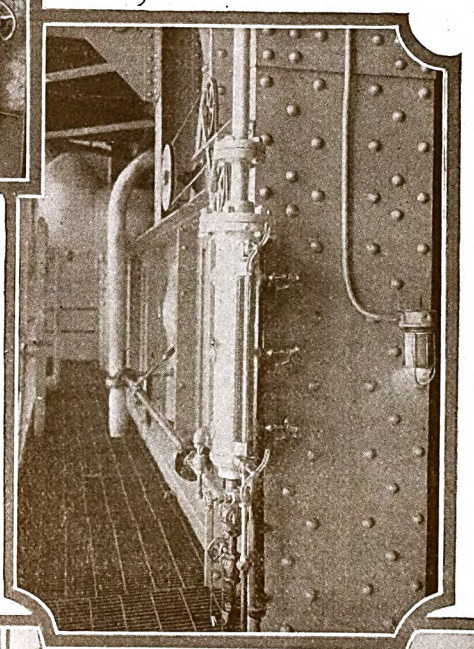


At the top of each boiler is a steam collecting drum which frees steam from entrained water before it goes to the superheater.



Each boiler is fitted with a complete equipment of soot blowing apparatus. This is shown above and is available from one of the mezzanine boiler galleries.

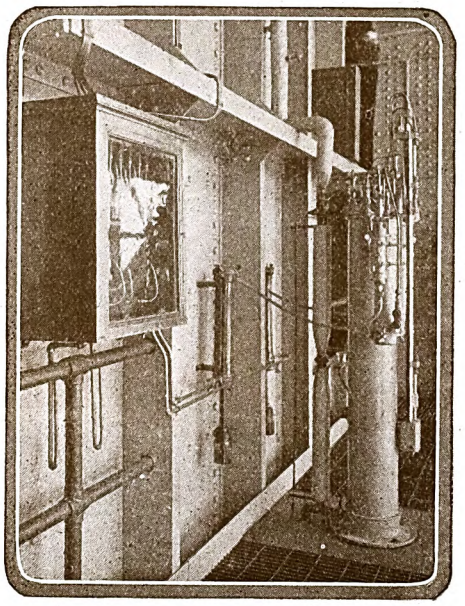
Another mezzanine gallery gives access to the safety water column and to the top steam drums when scaling is necessary.



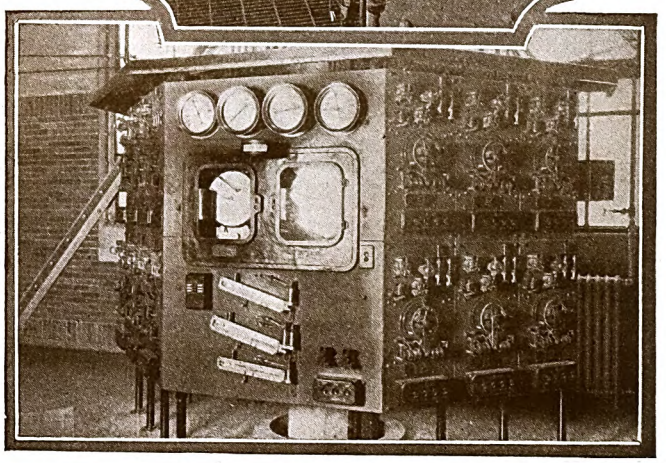
vided for burning fuel oil. It was by the use of these alternatives that the power plant was enabled to keep going during the recent coal shortage when operations would otherwise have had to have been curtailed.

Normally, however, this plant burns blast furnace gas and powdered coal. The gas is conducted to the power house from the blast furnace units by means of huge, riveted, steel-plate mains, the gas flowing under blast furnace pressure, being in fact pumped by the turbo-blowers. Sixty-seven million cubic feet of this gas is burned every twenty-four hours. It is fed to the huge furnaces or combustion chambers of the boilers through "Dutch ovens," located near the ash pits. There are four of these mixing ovens for each furnace, each one surmounted by a mixing valve which permits the inflow of gas to carry with it, by induction, a sufficient amount of air for its combustion.

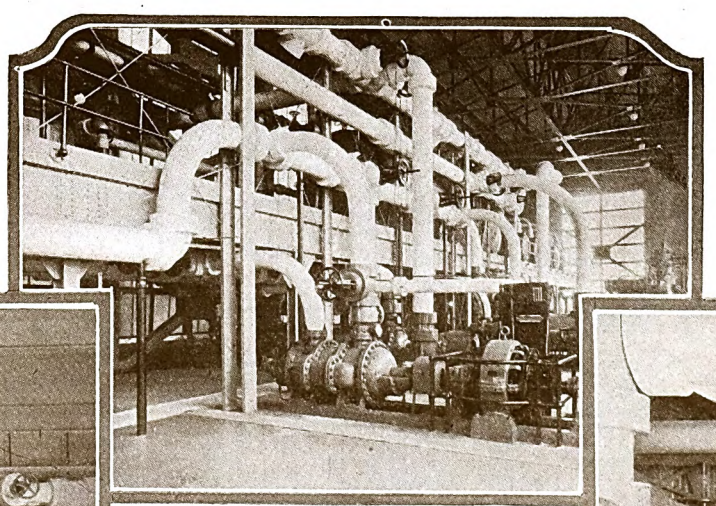
Approximately 250 tons of powdered coal are burned daily at River Rouge in addition to the blast furnace gas in



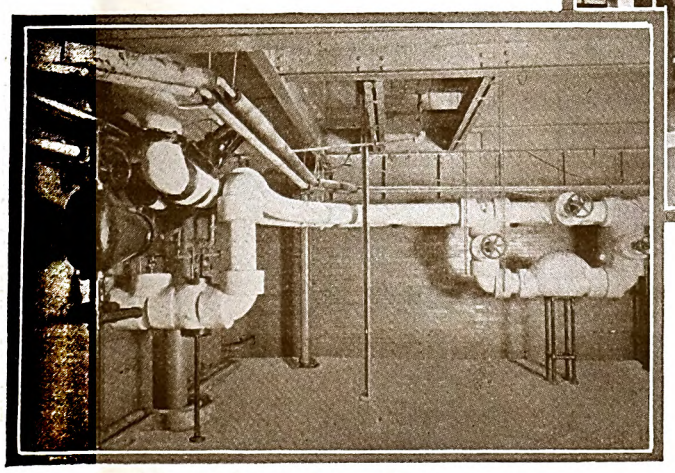
Automatic analyses of the flue gases are made at frequent intervals to determine the CO_2 content.



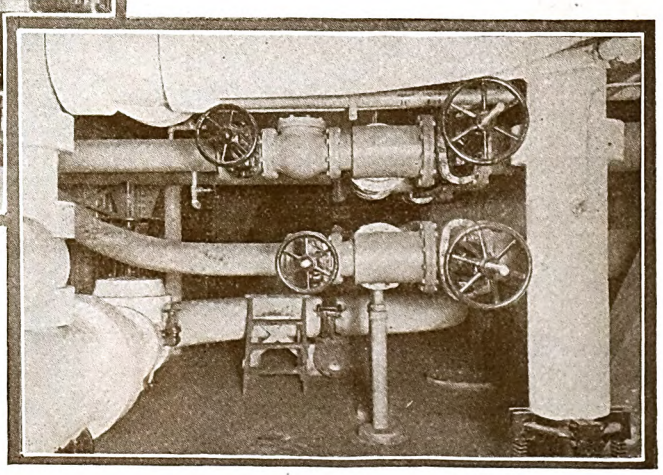
A control board is provided for each boiler with gages, recording instruments and push button control for all regulations.



Nothing but pure distilled water is allowed to enter the boilers at this plant. Above is a view of the evaporator room where the feed water make up is distilled.

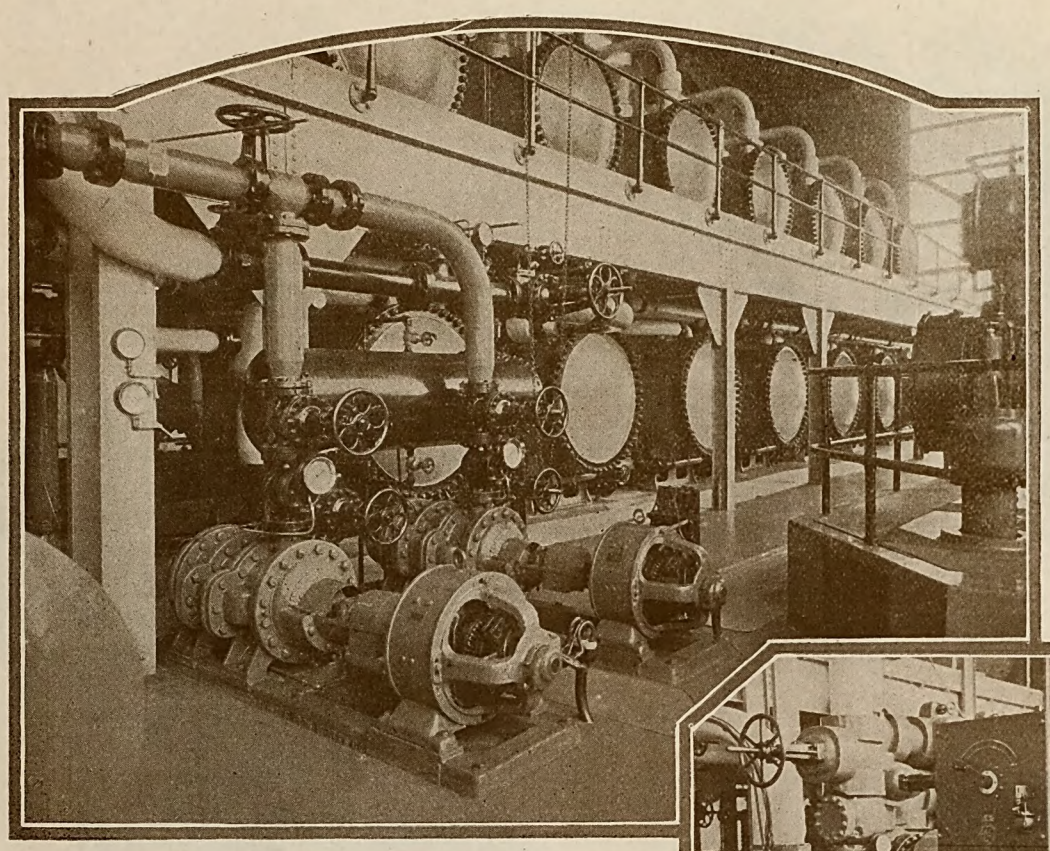


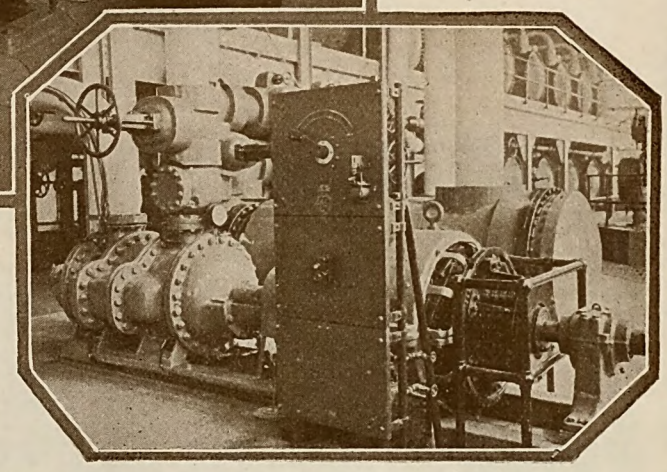
Condensate from the turbines, heating system, etc., goes to a hot well at the left of this picture. City water mains are provided for emergencies.



A view of one corner of the "pipe gallery" showing steam headers and condensate return lines leading to the hot well.

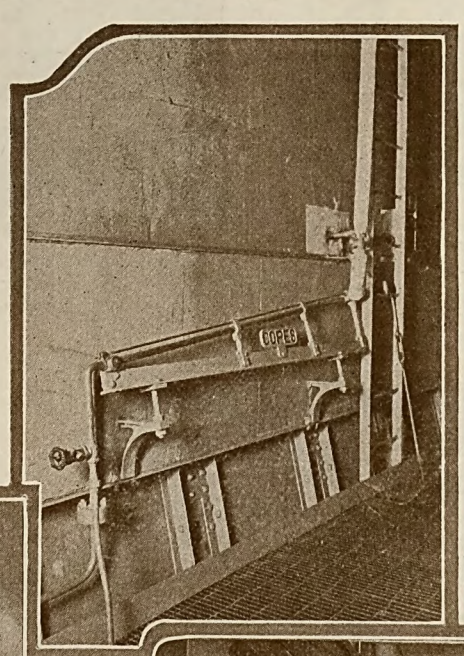
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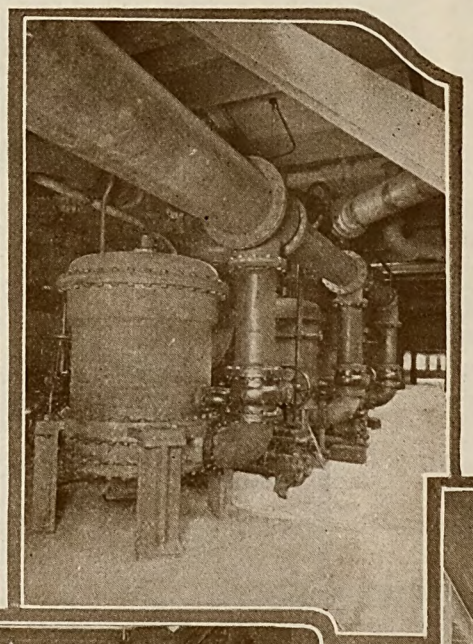


Above is a view of the "double effect" evaporating system for the distillation of feed water. In the foreground are two of the rotary boiler feed pumps.

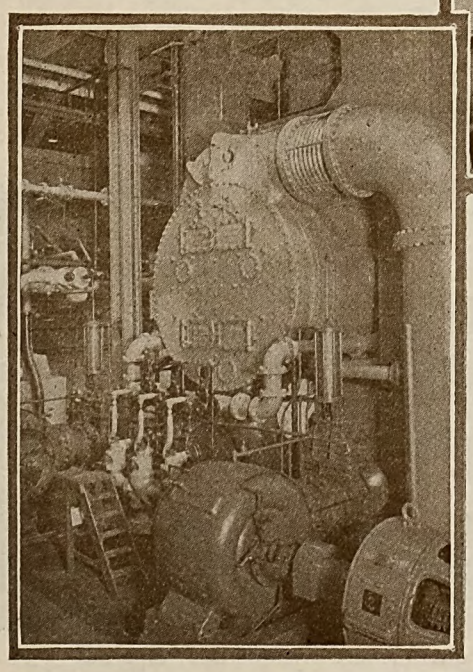
The load on these pumps is divided and controlled by an ingenious electrical regulator shown at the right.



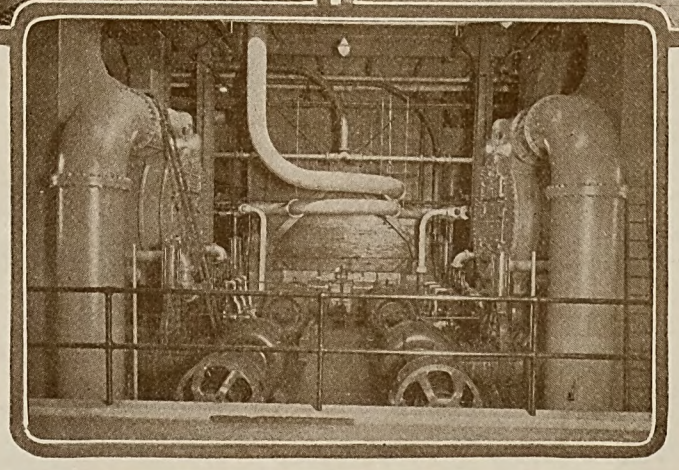
Feed water is admitted to the boiler at each end of each lower drum and is automatically regulated by the apparatus shown at the right.



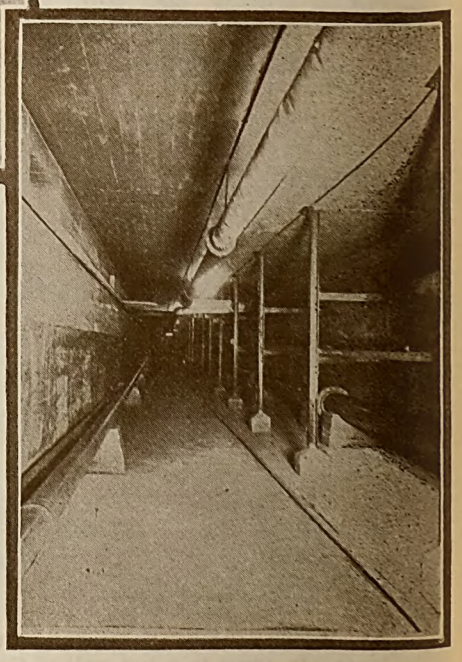
At the left is a view of the newly installed system of heaters used in connection with heating of plant departments by hot water.



Beneath the main turbo-generator units are surface condensers which maintain an average vacuum of 28½ inches.



A general view of the condenser pit is shown above. In the center background is the oil purifying and circulating system serving the main units.



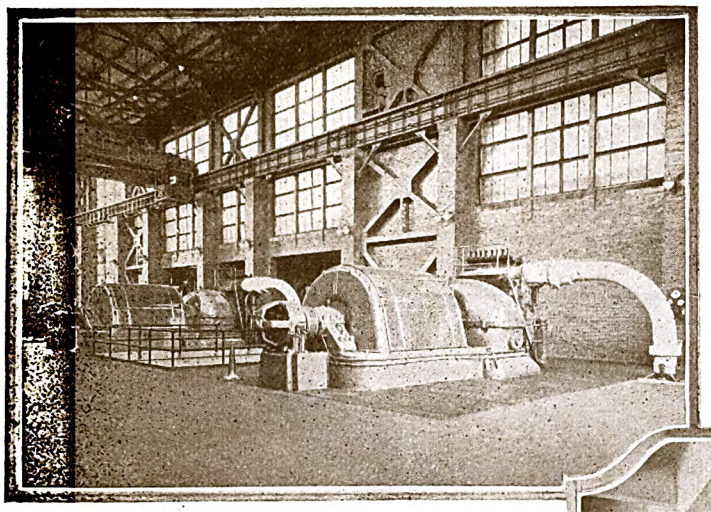
A view of the tunnel containing the hot water circulating pipes which lead to and heat the huge Rouge foundry.

the three boilers which are now kept in operation. The pulverizer building where this coal is pulverized is a steel-concrete structure, 200 feet long, 60 feet wide and 118 feet high, standing adjacent to the power house and attached to it by an overhead conveyor gallery.

On the ground floor of the pulverizer building are the grinding mills in which the coal is ground from nut and slack sizes so that eighty-two per cent of it will pass a 200-mesh screen. This operation is carried on in a *partial* vacuum, produced by fan exhausters which are connected with the grinding mills and which not only assure dustless operation but which also serve as the means of transportation of the finished pulverized powder from the mills to the separators on a floor above. For as soon as coal has reached its required fineness in the mill it is whirled away by this air suction and carried to cyclone separators.

The complete separation of air from powdered coal is necessary to prevent spontaneous combustion in its storage bunkers. Therefore after the coal has left the cyclones it is deprived of the remainder of its air content by being passed through long tubular cloth bag separators. Then the powdered coal is carried by bucket flight elevators to a system of spiral conveyors which lead across the gallery

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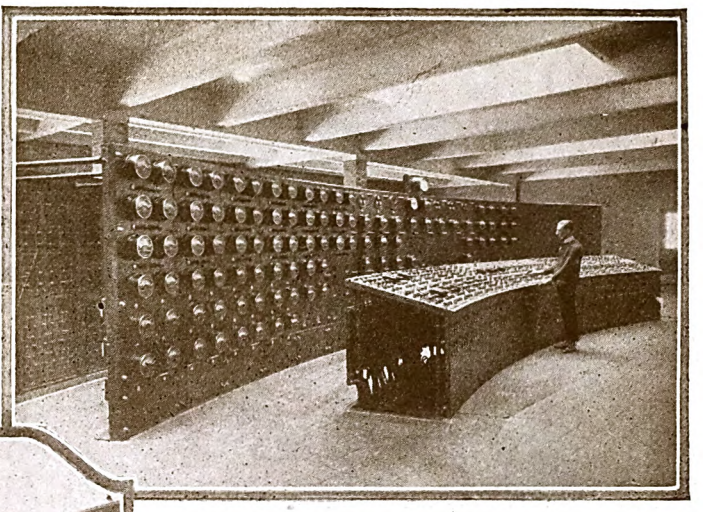
The two 12,500 kw. turbo-alternators now installed are but a beginning for the huge 500,000 horsepower project under way.

previously mentioned, being finally deposited in powdered coal bunkers ready to be fed to the boilers as fuel.

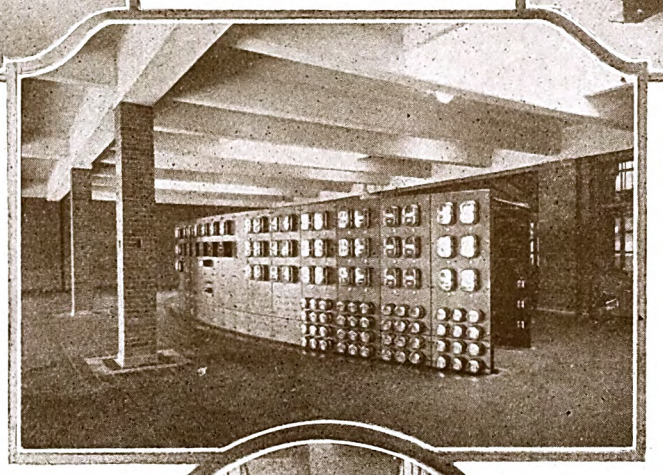
The pulverized coal is fed to the boilers at a rate depending upon their needs. This variation in feeding is made possible by means of ingenious screw feeders driven by variable speed motors, four of these feeders being provided for each boiler. The speed of these motors is regulated from the operating floor by means of push button control on the boiler control panels which will be described later on. After passing the screws of these feeders the powdered coal, met by a stream of air under pressure, is conducted to burners through which it falls into the combustion chamber, being admitted near the top of this and immediately over the Dutch ovens which admit the blast furnace gas. Thus the heavy coal-laden stream of air falling from each burner quickly becomes ignited and adds its efforts in B. t. u.'s to the total heat score.

The boilers at River Rouge are among the largest high pressure boilers in existence. Their total height from ash pit floor to the top of superheater piping is close to 83 feet. They are of the five drum type, having four steam and water drums and one top drum for collecting steam before it goes to the superheater. The furnaces of these boilers are in size approximately twenty-four feet square and fifty-five feet high. Each boiler with its superheater and setting, as well as its brick lined, eleven-foot diameter

(*Continued on page 56*)

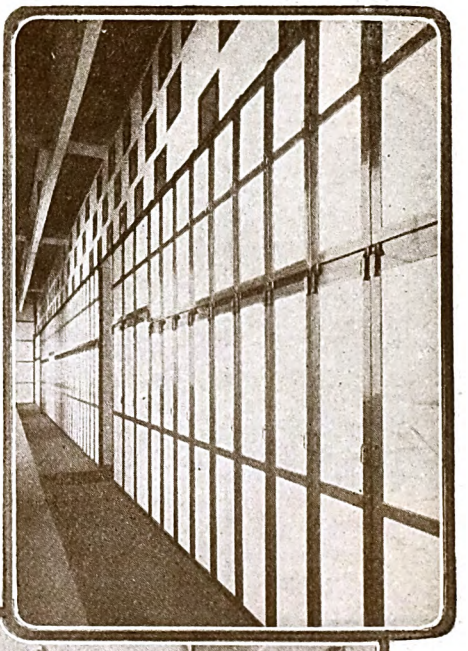


The electrical load is controlled and distributed by means of push buttons and signal lights from the panel in the control room shown above.

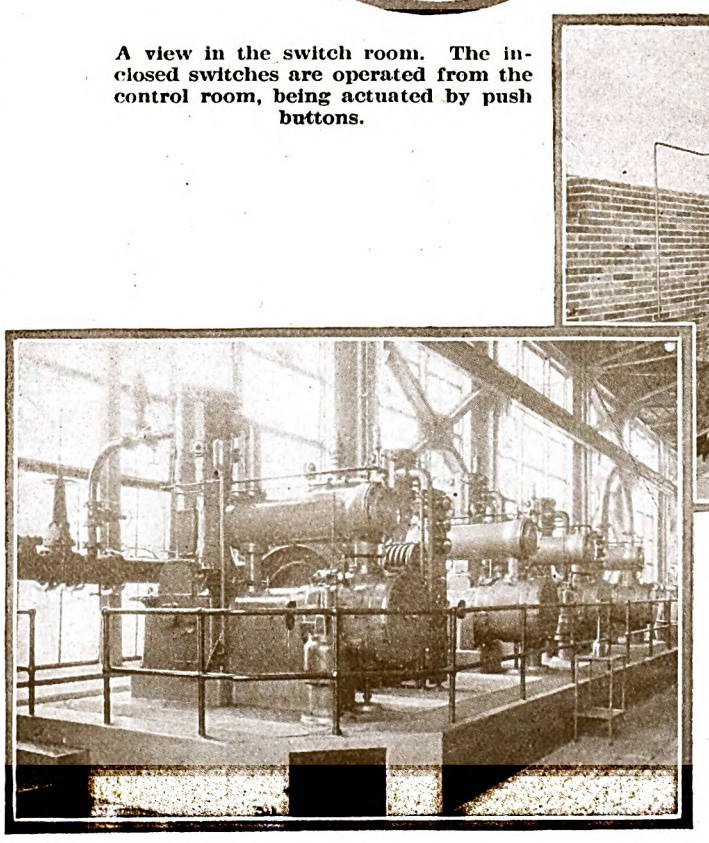


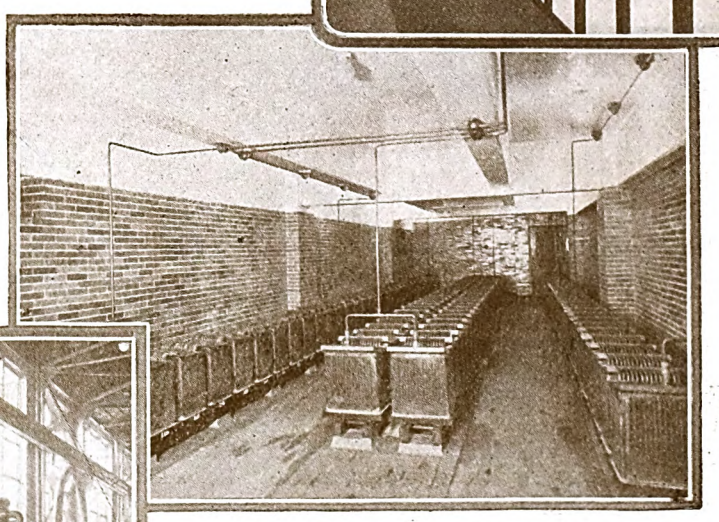
To avoid danger and fire risk the 4600 volt switches, bus bars, etc., are housed in insulated cabinets through which cooled, dehumidified air is circulated.





A view in the switch room. The inclosed switches are operated from the control room, being actuated by push buttons.





Above is the storage battery room which provides current for operating the control board and also for emergency lighting in case of breakdown.

Compressed air for plant use is provided by the compressor unit shown in the picture at the left.

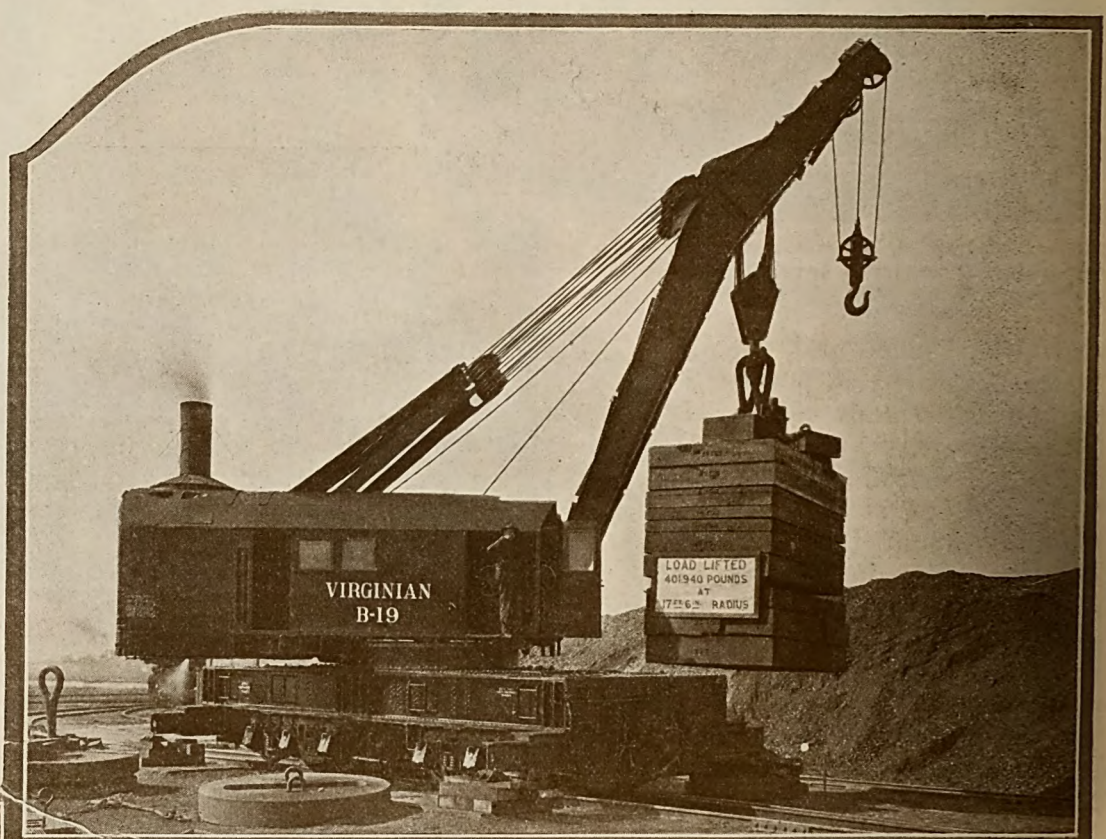
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Pictorial News of

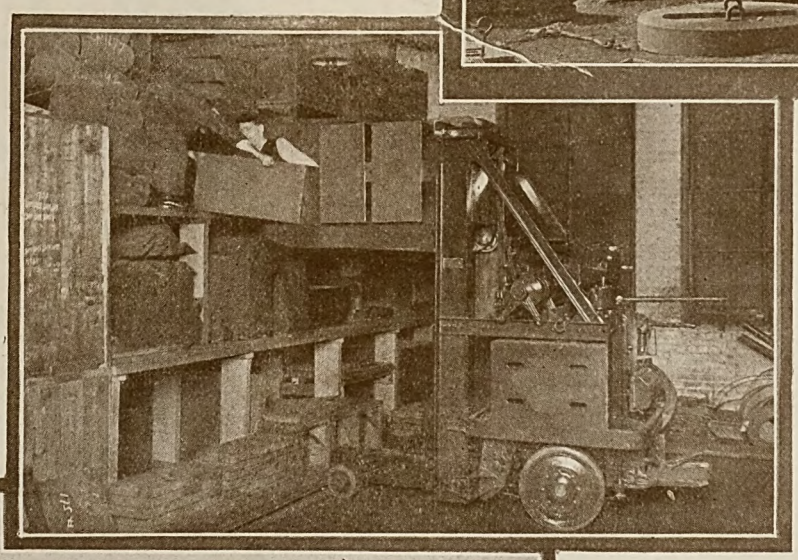
Recent Developments in



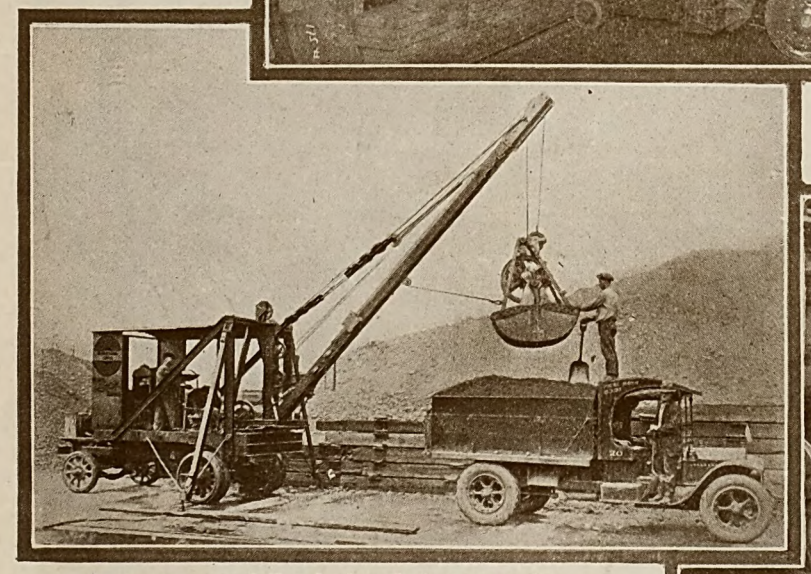
This apron and hood was developed to meet the needs of sand-blast operatives. The increasing use of steel shot as an abrasive called for better protection of the workers, and these "shot-proof" garments are now available for the purpose.



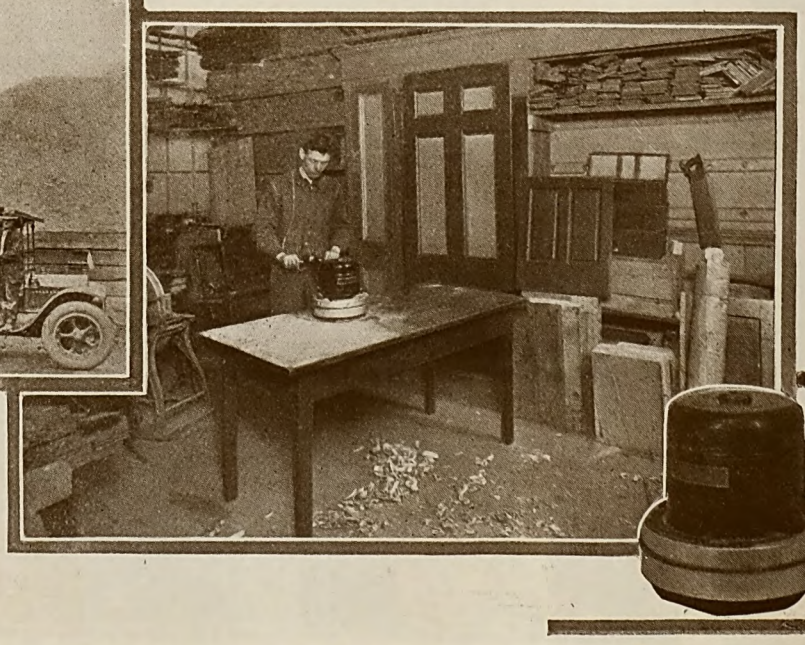
This is said to be the largest railroad wrecking-crane ever built. In use by the Virginian Railway Company, it has a capacity of 400,000 lbs. at a 17½ ft. radius. The main problem in its design was to keep within railroad clearances and axle loads, and yet obtain this immense capacity.



A well-known manufacturer of industrial trucks and tractors has recently added to its line the unit shown on the left. This truck is capable of lifting a two-ton load to a point 6 feet from the floor level, by cable-hoist mechanism, electrically operated.



A crane especially designed for mounting on a motor truck, is now available. The crane alone weighs only six tons. It is furnished with a 30-horsepower gasolene engine, and can be used for a variety of work where locomotive cranes would be too bulky or expensive to operate.

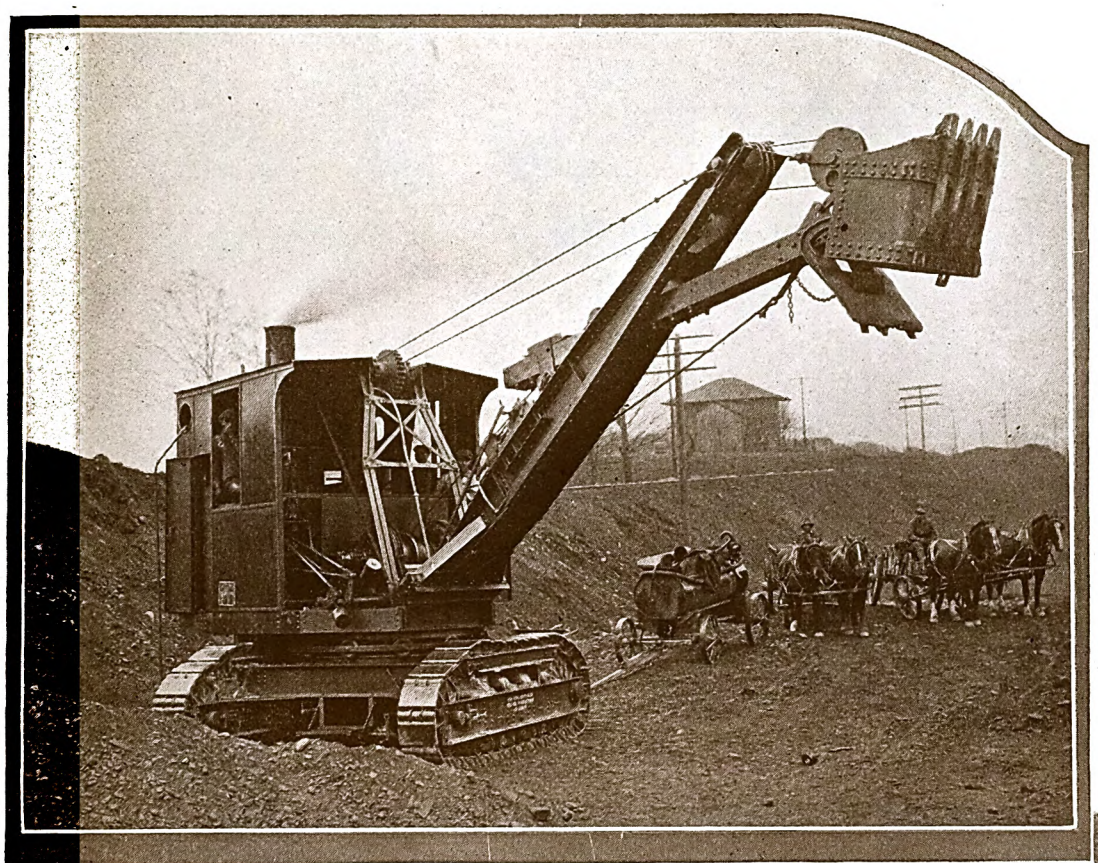


This bench type sanding and polishing machine is equipped with a one-third horsepower motor and weighs approximately fifty pounds. It is especially adapted to sandpapering tables, benches, etc., and to polishing or scrubbing such surfaces.

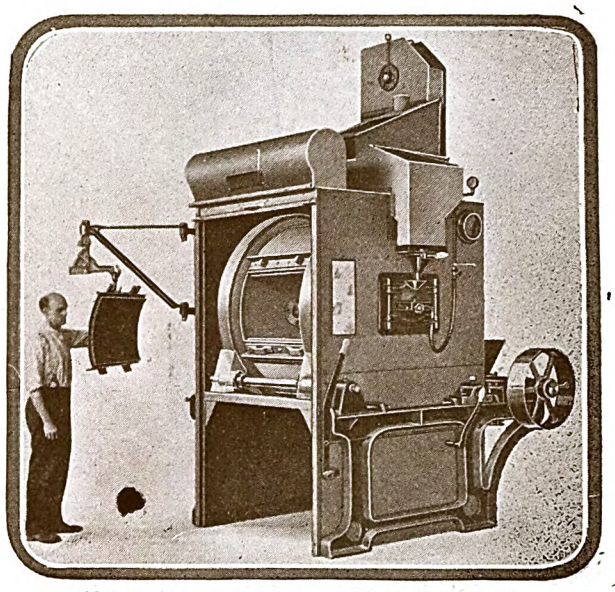
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the Machinery World

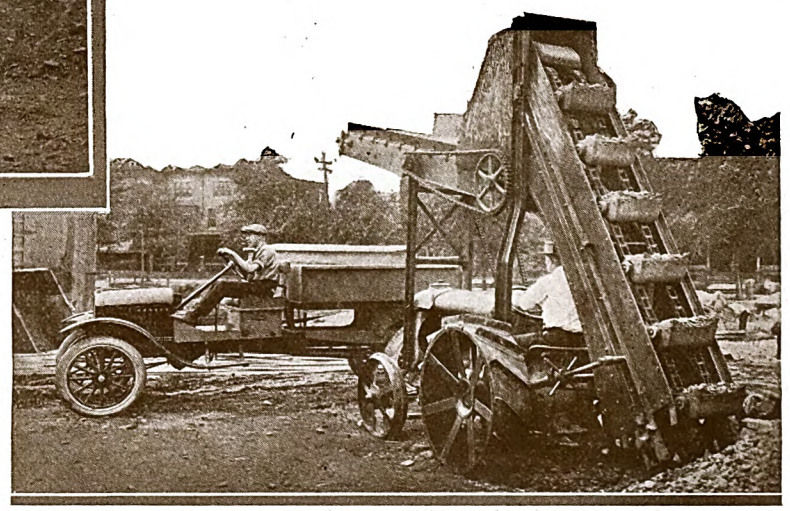
Labor-Saving Equipment



This combination crane and shovel combines the advantages of both in one unit. The crawling tread makes for mobility, while only a minimum of time is required to substitute shovel boom and dipper for ordinary crane boom. The radius of the boom may be varied; enabling the shovel to dig several feet below normal operating level, and also increasing the lift.

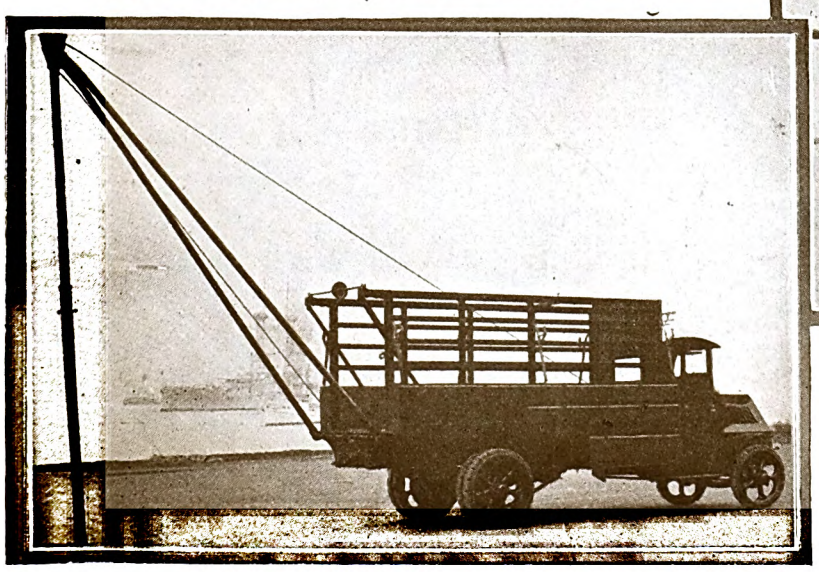


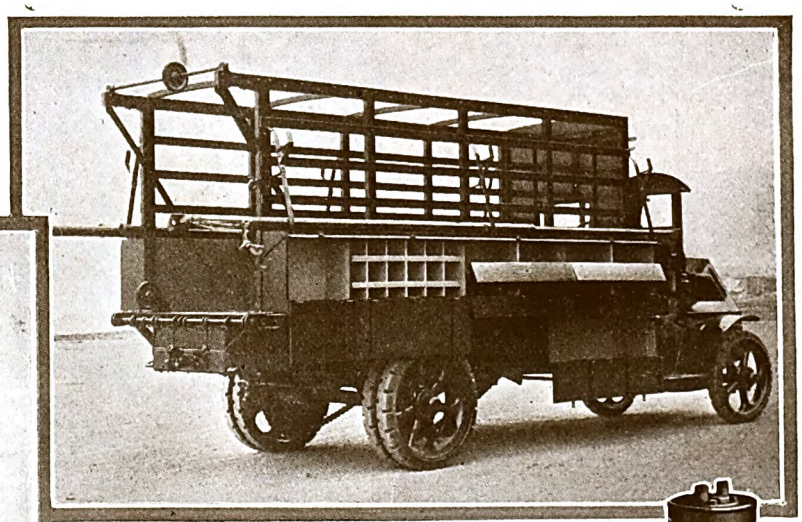
Above is a new sand-blast barrel, in which the nozzles are adjustable both vertically and horizontally; making for more economical operation on a wide variety of work.



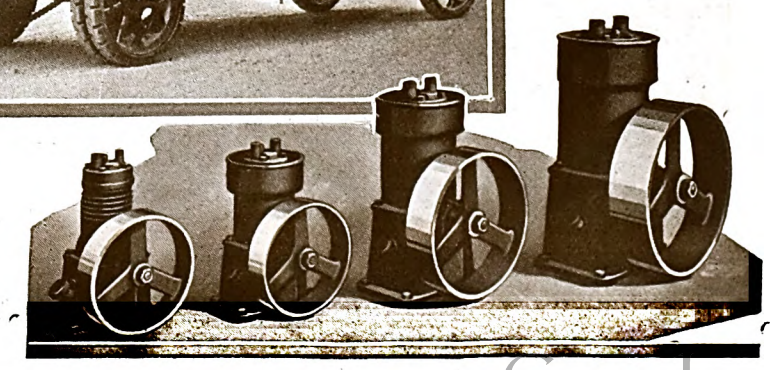
The above power-driven loader, mounted on a well-known make of tractor, furnishes a unit of wide usefulness. The loader is operated from the power shaft of the tractor, by endless chain.

Below and at the right are two views of the line department truck of the Flatbush Gas Company, Brooklyn, N. Y. Note the compact mounting of the rig for pole setting and cable pulling.



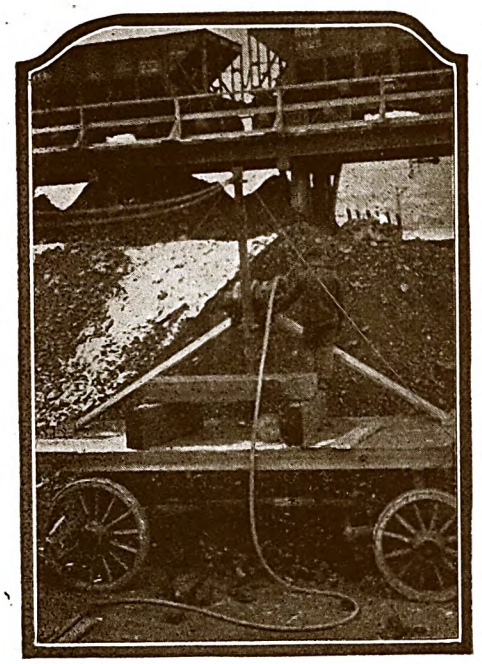


Below are four examples of a new line of vertical air compressors, in which constant level oiling and reliable regulation are features not usually found in small vertical belt-driven machines.

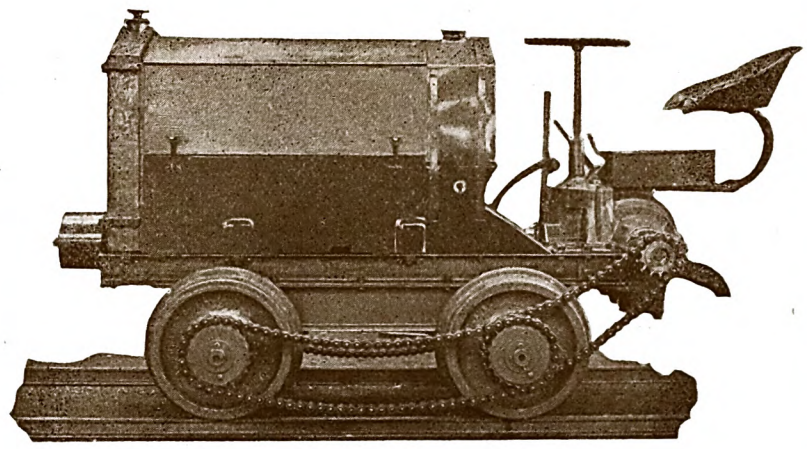


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Profit Possibilities Caught by the Camera



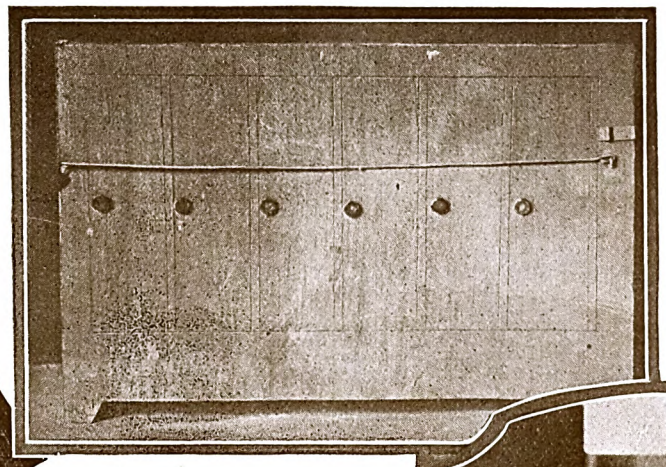
In order to allow dumping coal from this trestle for storage, the coal pile must be continually graded off. This little air hoist, operating scraper drag bucket, and handled by one man, replaces the twelve hand shovelers formerly used.

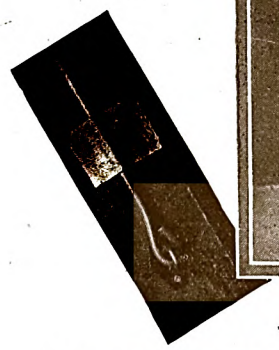


The International Patroleum Co., in Peru, found that road-building in that mountainous district was too big an undertaking; yet they had to haul their stuff somehow. A narrow gage track, with converted gasoline industrial tractors and trailers, solved the problem nicely.



The most up-to-date development of the flexible shaft. Used in conjunction with a portable electric drill, it has been found invaluable in the above Ford Repair Station.

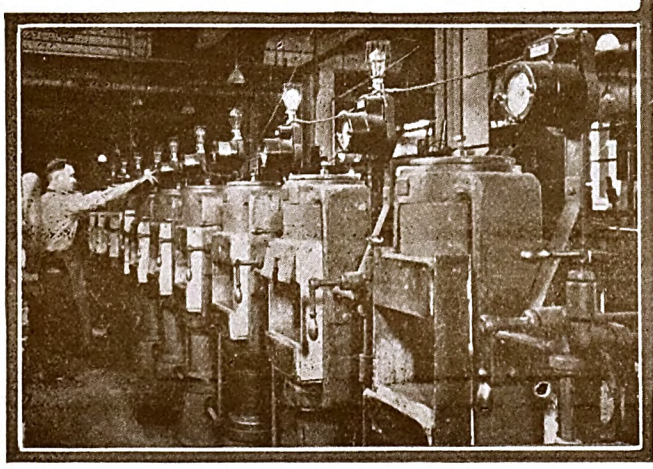




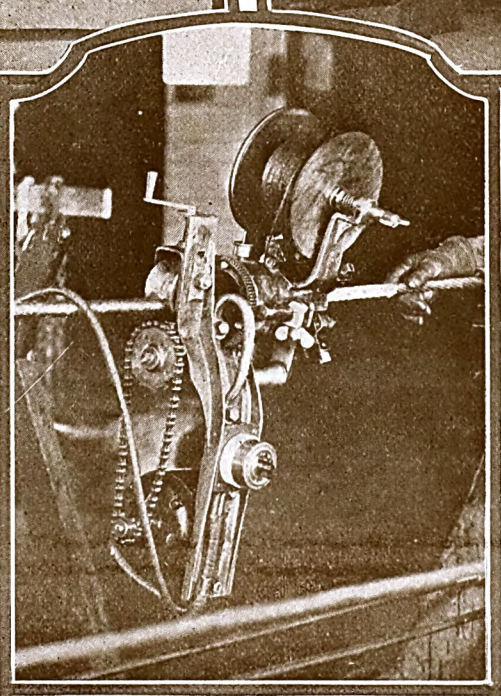
In a small eastern shop, the simple bar lock shown above—which locks all six lockers by means of a single padlock—gave security for the men's belongings at very slight cost.



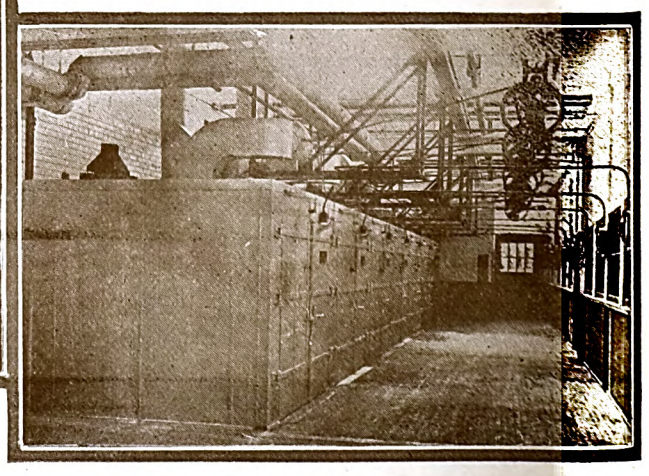
The pay car, shown above, enables the Eastman Kodak Company to pay off its plant in four minutes; quite an achievement, considering the size of the plant, with its thirty-six separate departments.



The above view shows a battery of ten hydraulic presses used in making hot moulded materials, equipped with Process Tinning Indicators. The exact time of completion of operation is automatically signalled to the operator.

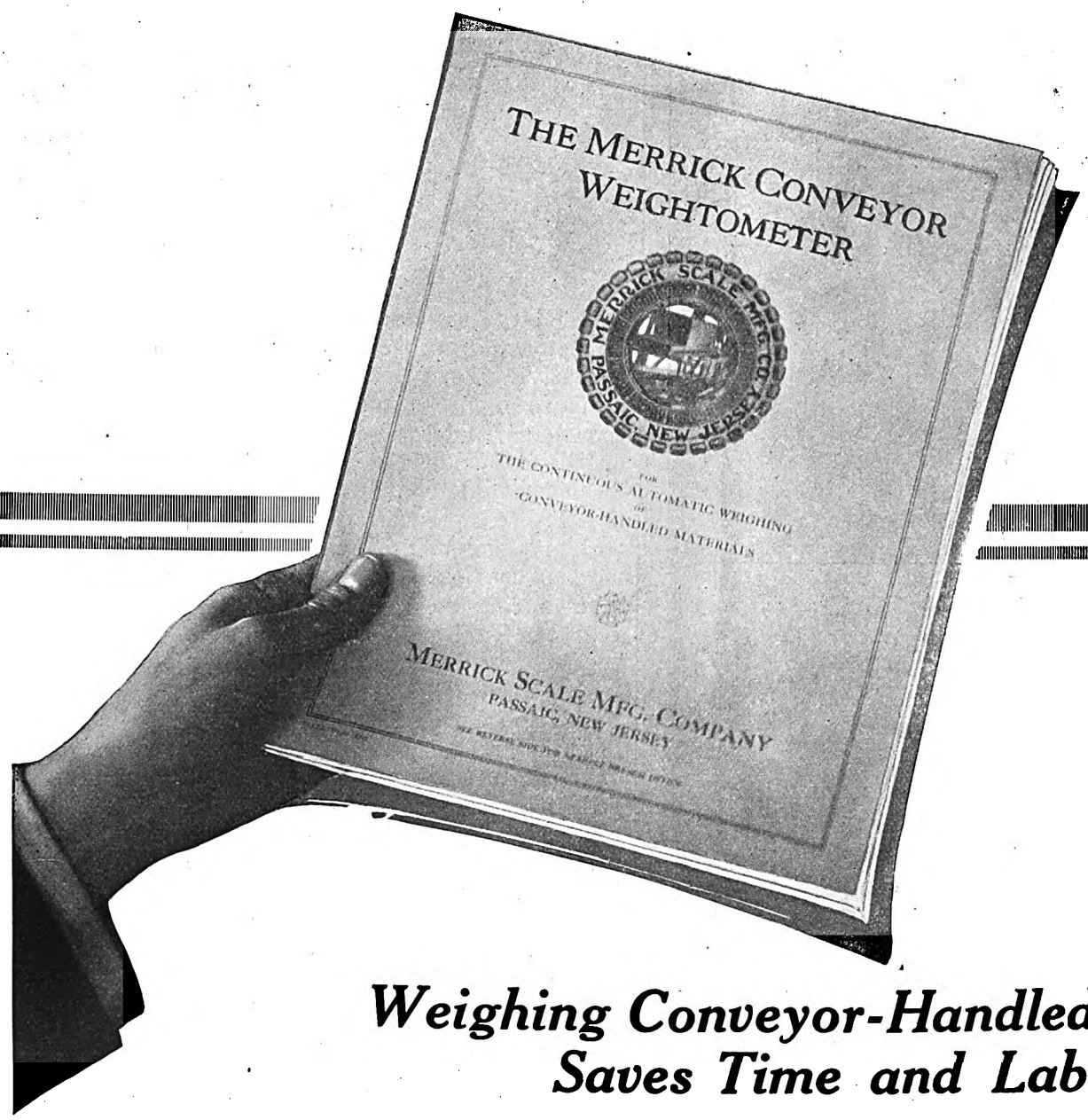


This rope-serving machine, developed by a rigger at one of our Navy Yards, has effected worthwhile savings over the old hand method. It can be operated from a lamp-socket, and in two years use has required no repairs or replacement.



The Ritter Dental Manufacturing Company of Rochester, N. Y., find that these electric japanning ovens have not only speeded up, production, but have reduced their percentage of rejections from 20% down to less than 4%.

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Weighing Conveyor-Handled Material Saves Time and Labor

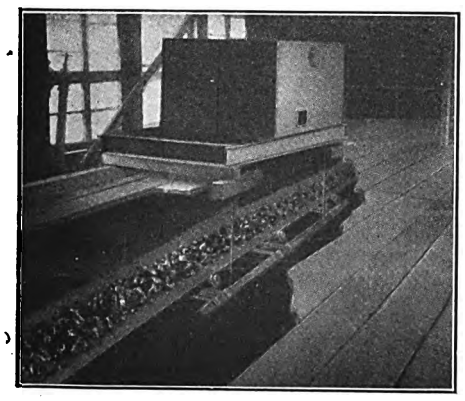
This Circular Shows How

THE MERRICK CONVEYOR WEIGHTOMETER

is designed for use on any size or style of belt, bucket or pan conveyor.

A few of the many commodities handled are Coal, Coke, Stone, Gravel, Cement, Sand, Ore, Salt, Fish, Fertilizer and other bulk material.

A Typical Merrick Weightometer Installation



Every executive should look into the economy of weighing conveyor-handled materials while in transit.

The **MERRICK WAY** makes this a simple operation. The **MERRICK CONVEYOR WEIGHTOMETER** weighs and records the weight of any material while being conveyed over a belt, bucket or pan conveyor, without interrupting the flow and needs no attendant or weightman.

IT IS GUARANTEED AND PROVEN 99% ACCURATE.

It enables you to tell **EXACTLY** how much material you receive instead of depending on Bill of Lading Weights.

This circular explains how hundreds of concerns buy and sell their products by using **MERRICK WEIGHTOMETER** Weights. It will prove to you that Merrick Weights will save time and labor and aid your production.

We will be glad to send a copy to any one interested.

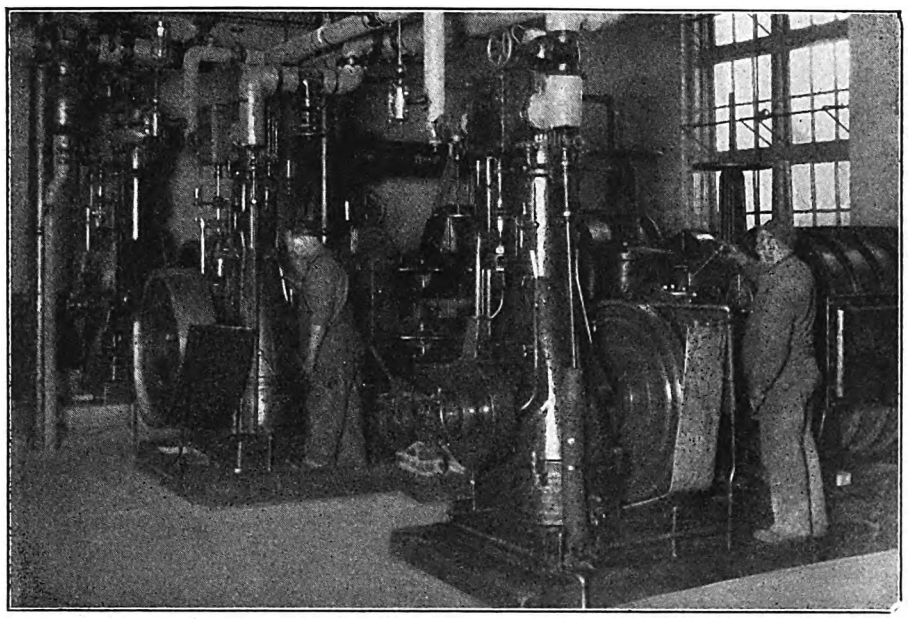
Write for a copy today.

MERRICK SCALE MFG. CO.

180 AUTUMN ST., PASSAIC, N. J.

The Merrick Weigh—Weighs While It Travels

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TROY ENGINES

....."give very satisfactory service and meet all requirements".....

ANOTHER Troy Engine was recently installed at the plant of the New York and Richmond Gas Company in Staten Island, N. Y.

This is the third one in eight years. The trouble-free service and absolute reliability of the other two Troy Engines led to the recent purchase.

The Troy Engine in the foreground of the above photograph drives a Wilbraham-Green Blower. The other two, are direct connected to Roots Blowers.

Although installed only three months the new Troy Engine is already paying for itself. It is used continually 14 hours out of the 24 and aids the Roots Blower in keeping up its capacity of 300,000 cu. ft. of gas per hour at a maximum pressure of 5 lbs.

The requirements of gas plant service are very exacting. Continuous duty is practically a requisite and the pressures must be maintained constantly.

That Troy Engines maintain a pressure that does not vary from day to day and that they require the least amount of attention is evident in the thousands of Troy installations throughout the gas industry.

Troy Engines are being used for stoker operation, for fans and blowers and for other purposes where compact, rugged small engines are required.

The Troy Catalog explains the many exclusive features such as the self oiling system, the balanced steam-tight valve, etc. Write for a copy.

TROY ENGINE & MACHINE COMPANY

TROY, PENNSYLVANIA

Built in sizes 2 to 200 B.H.P. --
Vertical, Horizontal, Belted and Direct-Connected.

TROY ONLY STEAM ENGINES GOOD ENGINES ONLY ENGINES

Is a Letter a Contract?

BY LESLIE CHILDS

FROM the standpoint of the factory, or other industrial executive, there is probably no more important question of law than that involved in the sufficiency of letters to form an enforceable contract. This is true because such an executive may enter into hundreds of contracts through this medium during the course of a year, the legality of which may be the determining factor between success and failure for the period covered.

In the first place, in the light of the statutes of frauds, in order to form an enforceable contract by virtue of letters, some item or items of such correspondence must be signed by the party sought to be charged; and this signed item, or letter, if it is to be relied upon, must refer expressly to the contract sought to be enforced. It follows then, that a series of letters written by one party to such correspondence will not bind the second party, unless the latter's signature appears upon some item of the correspondence referring directly to, and affirming, the contract.

This point of commercial law has been frequently overlooked by well informed business executives, and has led to much costly and futile litigation in after attempts to enforce agreements, which were grounded upon correspondence, which fell short of charging the opposing party in this respect. This danger point is illustrated in a long line of well considered decisions, among them being Western Metals Co. vs. Hartman Ingot Metal Co., 303 Ill., 479. This case is perhaps one of the clearest on the point the books contain, and is well worth examination by every executive charged with the conduct of correspondence of this kind. The facts involved, as taken from the report were, briefly stated, as follows:

The president of the plaintiff company met the president of the defendant company by chance in Cleveland, Ohio, and there was some conversation between them relative to the sale of a quantity of scrap brass by the former to the latter. Thereafter the plaintiff wrote the defendant in confirmation of the sale, upon a printed blank, in substance, as follows:

"Confirmation * * * Sales Order No. 2053, Date November 2, 1918. Sold to Hartman Ingot Metal Company, Chicago, Ill. Terms, 30-day acceptance draft for 90% of the invoice, f. o. b. Chicago. Shipment to be made any time between now and 1/31/19.

"Quantity and material Prices
25 tons No. 1 red brass borings .....per lb. 20c
25 ton clean light brass .....per lb. 13c

After receiving the above letter of confirmation the defendant company, through its secretary, wrote the plaintiff as follows:

"Gentlemen: We will absolutely refuse to accept any shipments of metals until such a time as you are again notified by us to the contrary, owing to the fact that we are so badly congested here at the present time. Trusting you will give this matter your attention, we are," etc.

Following this, considerable correspondence passed between the parties, the plaintiff asking for shipping instructions, and the defendant declining to give them. Finally the defendant wrote the plaintiff as follows:

"On account of the government canceling orders on all purchases they have made, we are likewise canceling all written orders we have given our trade. We might have given you a verbal order, and this would be under the same ruling as all written orders we have given others."

After the receipt of the above letter the plaintiff brought an action against the defendant upon the contract

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and recovered a judgment for $4,500 in the lower court. This judgment was reversed in the Appellate Court, on the grounds that the action was barred by virtue of the statute of frauds, which provided as follows:

"A contract to sell or a sale of any goods * * * of the value of $500 or upwards shall not be enforceable by action unless some note or a memorandum in writing of the contract or sale be signed by the party to be charged or his agent in that behalf."

Following the judgment of the Appellate court the case was taken to the Illinois Supreme court where in reviewing the record, and in determining whether or not the correspondence outlined above satisfied the section of the statute of frauds quoted from, it was, in part, said:

"It is well established that a complete contract, binding under the statute of frauds, may be gathered from letters, writings, and telegrams between the parties relating to the subject-matter of the contract and so connected with each other that they may be fairly said to constitute one paper relating to the contract, though only one of the writings may be signed by the party to be charged. * * *

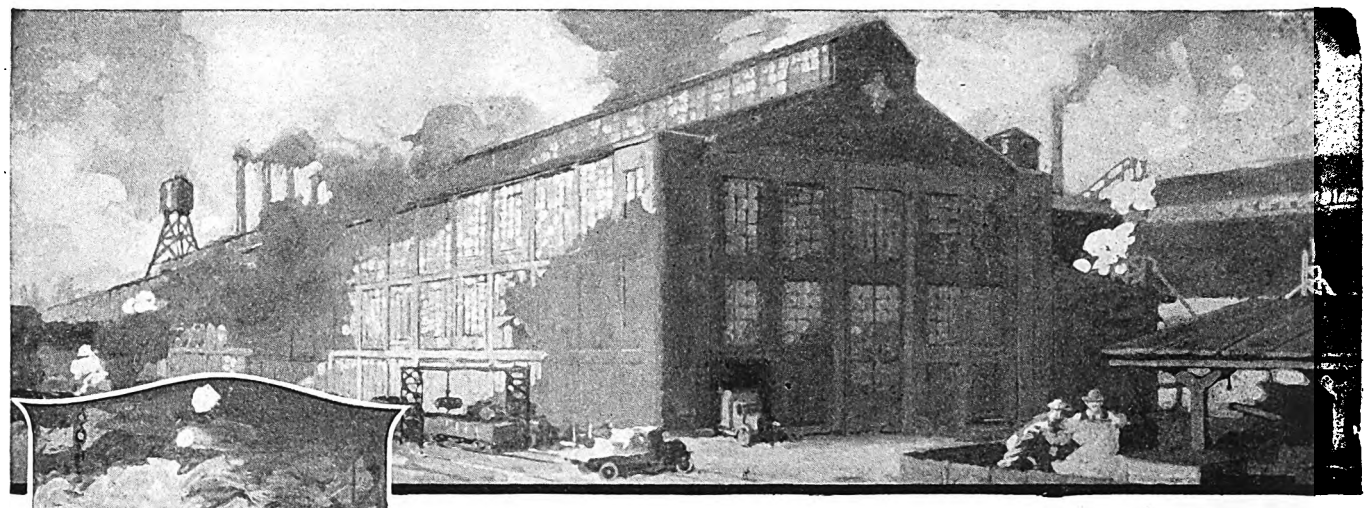
"It is equally well established that the signed writing or writings must refer expressly to the other writing, or the several writings must be so connected, either physically or otherwise, as to show by internal evidence that they relate to the same contract. * * * A paper signed by the party to be charged cannot be incorporated in a paper not signed by him by a reference in the letter. The signed paper must refer to the unsigned paper in clear and distinct terms. * * * "

After the above statement of the general rule governing the sufficiency of letters to form an enforceable contract, in the light of the statute of frauds, the court directed its attention to the correspondence in the instant case. In passing upon the sufficiency of these letters, the court, among other things, said:

"Turning, now, to the several writings in the case at bar, what do we find to connect them? It must be apparent to any one that the correspondence admitted the existence of a contract of sale, but that is not the question for us to decide. * * * The only question presented to us is whether there is a memorandum of this contract of sale, complete in all its terms, and signed by defendant in error. There is no contention that such a memorandum exists unless the letters signed by it are connected with the confirmation dated November 2, 1918, as to make the confirmation and the letters a memorandum sufficient to satisfy the requirements of the statute.

"The correspondence will be examined in vain in an effort to find the slightest reference to the confirmation. At no time does the defendant in error admit that the confirmation correctly states the terms

(Continued on page 31)





Even the most modern industrial buildings are made more profitable by these specialists

VENTILATION is a thing easily overlooked — a condition that does not demand attention until after production is under way.

When the new building is planned, every modern labor-saving device and method is considered. But it is only after the payroll has started that the menace of smoke, gas, heat, steam, foul air, or fumes makes itself apparent.

Arex engineers daily find new buildings in which the effectiveness of modern equipment is nullified by the lack of proper ventilation. They reveal hidden profits in every industry—men unable to perform efficiently—machinery not functioning properly—material spoiling because of conditions—hundreds of savings of such magnitude that the cost of their corrective system of siphonage ventilation is only incidental.

A rough sketch or blue print of your building attached to the specification blank below carrying a description of your conditions will bring you a complete survey by these experts without cost or obligation. Address Arex Company, Engineering Division, 1583 Conway Building, Chicago.

Arex Ventilation Is Used by the Leaders in Every Field of Industry

General Electric Company
Hart Parr Company
Quaker Oats Company
Oliver Plow Works
Pullman Company
National Biscuit Company
Wm. Wrigley, Jr. Company
Munson Steamship Company
American Car & Foundry Company
Corn Products Refining Company
Continental Can Company
American Can Company
National Carbon Company, Inc.
International Harvester Company
American Steel & Wire Company
Elgin National Watch Company
Henry Disston & Sons, Inc.
Western Electric Company
American Sheet & Tin Plate Company
Crane Company

Send rough sketch or blue print of building with data for engineer's analysis

AREX COMPANY
J. C. Kernchen, Pres.
INDUSTRIAL VENTILATING ENGINEERS

Arex Ventilation Engineering Survey SPECIFICATION BLANK

We desire to receive *Gratis* an engineer's analysis of the following building: ..... *State character of work or business building is used for*

We are troubled with: Fumes ☐ Smoke ☐ Foul Air ☐ Heat ☐ Condensation ☐ Steam ☐

Dimensions of Building: Width.....Ft. Length.....Ft. Ceiling Height.....Ft.

Construction of Building: State whether Brick ☐ Concrete ☐ Frame ☐ Stucco ☐

Type of Roof: State whether Flat ☐ Slant ☐ Gable ☐ Sawtooth ☐ Monitor ☐

Pitch of Roof..... State how many..... inches to the foot.....

Location of Floor or Room to be ventilated.....

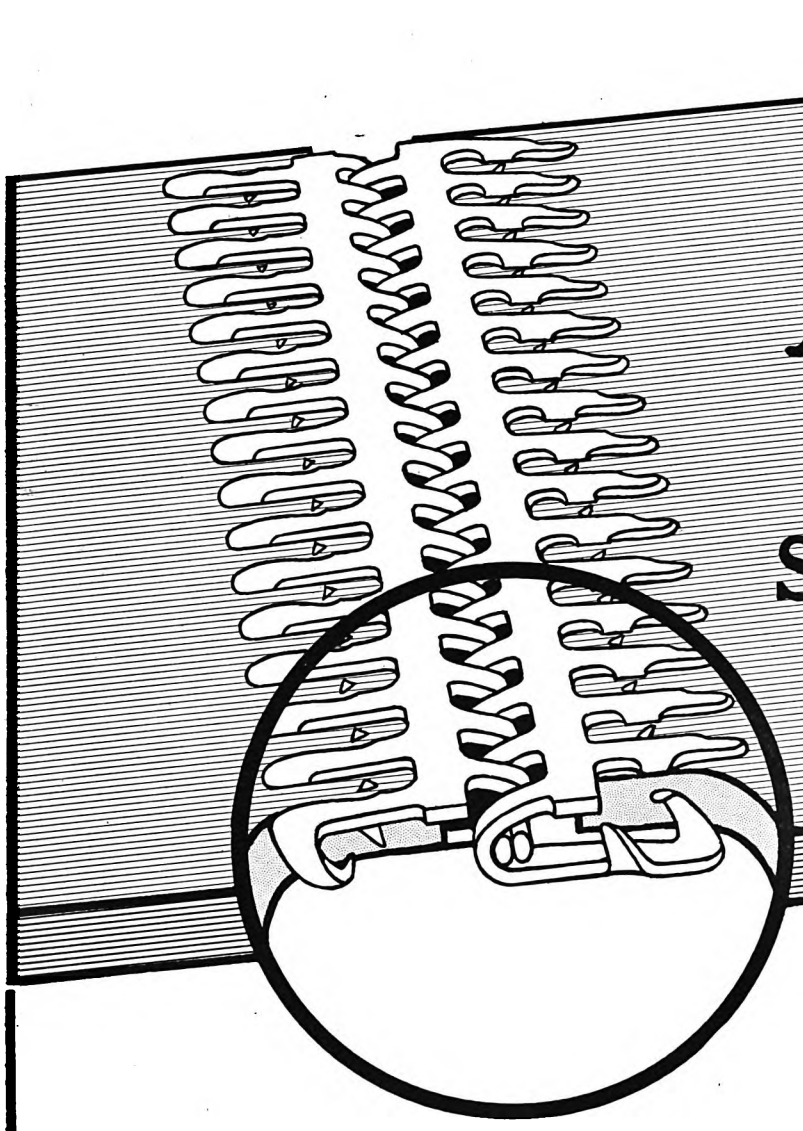
How high do adjoining Buildings extend over your Roof?.....

How many feet distant are the surrounding Buildings, or is your Building entirely unsurrounded?.....

Firm Name ..... Name of Individual ..... Title of Individual .....

Street Address ..... City ..... State .....

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Scientific

STEEL BELT LACING

Setting New Standards in Belting Performance

BELTS give longer uninterrupted service when laced with Alligator Steel Belt Lacing, for Alligator is the strongest and most durable of all belt lacings. It is scientifically and practically correct.

Every Alligator tooth is a vise, clinching around the belt fibres, holding them in equal permanent service.

Practically all authorities on belt transmission recommend Alligator. It is in every day use on millions of belts of every type and size and in every service. Sold at wholesale and retail the world over.

Flexible Steel Lacing Company

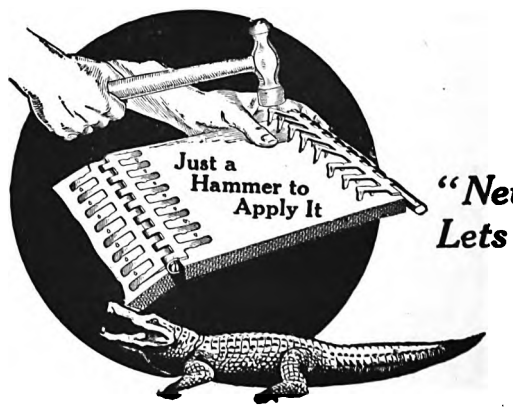
4639 Lexington Street, Chicago

In England at 135 Finsbury Pave, London, E. C. 2

From the Standpoint of Science

Alligator teeth penetrate lengthwise of the belt leaving the long burden bearing fibres intact. Each tooth clinches down over its group of fibres, compressing them firmly so that there is no internal friction and wear at the belt end. Likewise the sectional steel hinge pin eliminates wear, the smooth oval bases rocking against each other.

Keep these vital features in mind when you buy belt lacing for the cost of any lacing is nothing as compared to the cost of the belt on which it serves.



"Never Lets Go"

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THE SEAT OF
Production



No. FS-22, Patented.
Adjustable Legs and
Back-Rest

Stools and chairs that cost you less are costing you more than "Royal-Chicago" Scientifically designed seating every single day you are using them.

Royal Metal Mfg. Co.
2312-22 S. Western Ave. Chicago

"Royal-Chicago"
PRODUCTS
THE CORRECT INDUSTRIAL SEATING

(*Continued from page 29*)

of the contract. In fact, defendant in error does not even admit in its correspondence the existence of the oral contract of sale, there is nothing in the letters, or in any paper to which the letters refer, that states any of the terms of the contract.

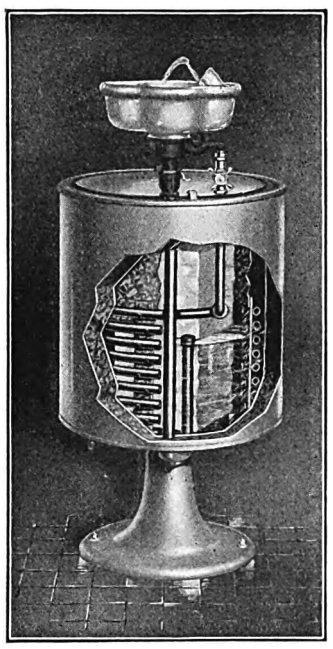
"It is unquestionably the law that the memorandum upon which it is sought to charge a party to a contract must state the contract with such certainty that its essentials can be shown from the signed writing, or by some reference contained in the signed writing to some other writing, without recourse to parol proof to supply the essential elements of the contract or to supply the connecting links between the signed writing and some other writing or writings. It is clear that the correspondence offered in evidence in this case does not meet these requirements. * * * "

In conclusion the Illinois Supreme court affirmed the judgment of the Appellate court. Holding, as outlined in the opinion, that the correspondence in the record was clearly insufficient to satisfy the requirements of the statute of frauds and make an enforceable contract.

The foregoing decision is obviously one of great force and clearness on the point decided, and in the light of the facts in evidence the correctness of the court's conclusion cannot be questioned. Nowhere in the correspondence did the defendant in error sign any memorandum that affirmed, acknowledged or admitted, the terms of the contract that the plaintiff in error sought to enforce, as required by the statute of frauds. Truly this decision, when examined in connection with the correspondence outlined, is one of value for every executive having in charge correspondence designed to lead to the formation of contracts of sale or purchase, as it illustrates in a striking manner what at least will *not* make an enforceable contract in situations of this kind.



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DOES THIRST QUENCHING COST YOU $18000.00 PER YEAR?

With 1000 employees in your factory at an average wage of 30 cents per hour—six drinks per day, two minutes per drink—the cost of thirst quenching is $60 per day or $18000.00 per year.

If your workmen are compelled to wait in vain for the water to cool, your pro rata cost is more.

Halsey Taylor instantaneous Cooler Fountains at frequent intervals throughout your plant save valuable working time and increase efficiency and production.

There are vital reasons why more than a score of corporations have each between 100 and 1000 Halsey Taylor Fountains in use:—The time-saving element, increased efficiency on the part of the workmen, and the superior Halsey Taylor construction with three important exclusive features, including positive and uniform control of the height of the stream.

Write for new 32-page catalog.

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237 Rialto Building

HALSEY TAYLOR

The Economic Importance of Pure Drinking Water

BY SANFORD DEHART

Director of Hospital and Employment Manager, The R. K. LeBlond Machine Company

RECENTLY two investigators were able to prove that drinking fountains, which were considered sanitary, were the positive source of contamination in transferring communicable diseases.

Several of these fountains discharged water vertically with a jet less than one inch, necessitating the consumer's lips coming in contact with the nozzle.

It has long been known that so called sanitary drinking fountains are subject to contamination unless the water is discharged from fountains at an angle, and the nozzle protected by some device which prevents the consumer's lips coming in contact with it. The ordinary spring faucet inverted and protected by a wire guard mounted on a tripod is infinitely more sanitary than a drinking fountain discharging water one or two inches vertically, which is not protected against the approach of the drinker by a wire muzzle or guard.

An investigation of types of drinking fountains, by the Board of Health of Minnesota, at the University of Minnesota, showed that of fifteen types examined, many of which were of the continuous-flow type and discharge water vertically, were all subject to contamination by the consumer, either directly by the lips or by falling back from the lips upon the jet or the surrounding parts.

There are several cases on record where it has proved costly for employers to furnish employees with drinking water without taking all precautions to protect it from pollution.

It cost one large manufacturing concern $150,000 and another $100,000 in the past six years for claims arising from a typhoid epidemic in their shops, which was directly traceable to contaminated drinking water.

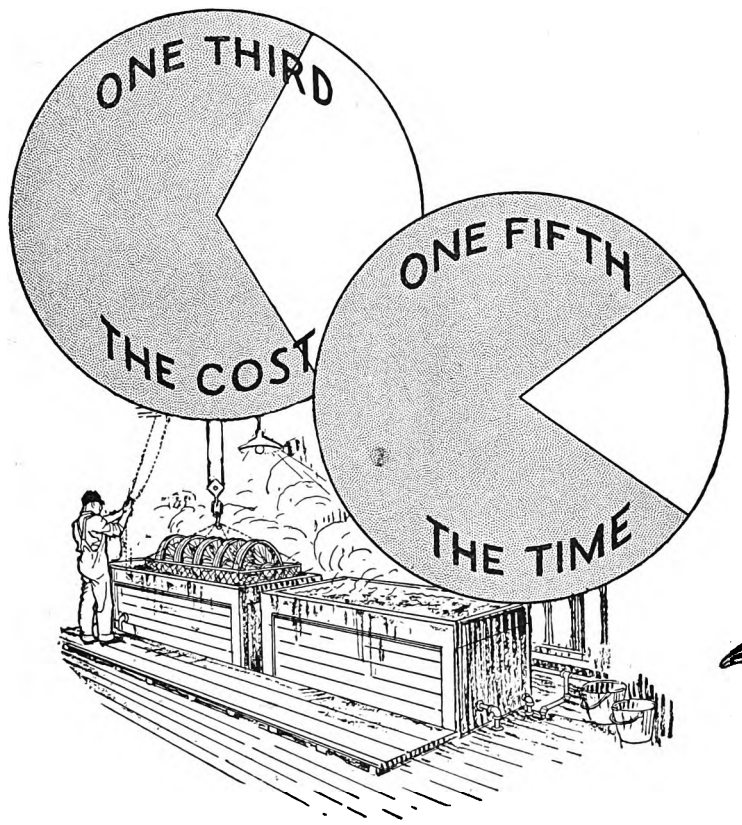
Most states require the employer to furnish pure water to the employees. In New York the law says that drinking water shall be supplied at all times, in places accessible to the employees, and shall be cold. In this state the water must be supplied through proper pipe connections. Where water is placed in receptacles in the factory, these must be properly covered to prevent contamination, and be thoroughly cleaned at regular intervals. The law goes on:

"In mines it shall be the duty of the operator of every mine to provide a good quantity of drinking water for the use of all men employed in the mine, a supply of which shall be provided on each main working level, and it shall be the further duty of the superintendent to cause such supply of water to be adequately protected from contamination."

There is no better way of transmitting diseases of a communicable character than by the common drinking cup. Many persons have contracted diseases from the public drinking cup, among which might be mentioned, tuberculosis, syphilis, tonsilitis, La Grippe, etc. This list is intended to be suggestive rather than exhaustive. Practically every state in the Union has abolished the use of the common drinking cup in all public places, by state law or regulations of the State Board of Health. A drinking fountain with an angle stream will

(*Continued on page 35*)

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to clean RIGHT ask JOHN BRIGHT

Stripping Japan with speed and economy with International Compound No.2B at 8c a pound

A GREAT Wire Wheel Plant was spending too much time and money in its cleaning department. One operation was particularly costly: The removal of the three coats of baked black Japan from the wheels.

A solution costing 10 cents per gallon took five hours to strip the work, and even then the Japan was not thoroughly removed. It was almost invariably necessary to brush the wheels after they were taken from the tanks.

Then International Compound No. 2B was introduced. It cost 3 cents per gallon and removed every trace of Japan in only one hour.

Better cleaning results are now being obtained with a great saving of labor, at approximately one-third the cost of material and one-fifth the time.

Of course INTERNATIONAL COMPOUND No. 2B will not strip every japan job in less than an hour, but it will strip any kind of japan or paint quicker and cheaper than you are doing it at present. Let me prove this to you by shipping you a barrel for trial. If it doesn't do all I claim, return what is left after testing and cancel our invoice. Awaiting your trial order,

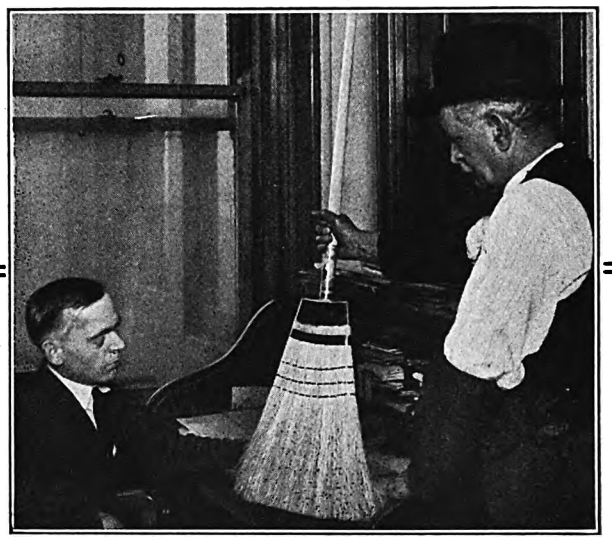
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"We Want this RED CAP Broom!"

—says the Superintendent to the P. A.

"Hereafter, Fred, let's standardize on RED CAPS. The boys tell me that one of these RED CAPS outlasts two or three of the wire-wound brooms we've been using, and does better work. They say the bamboo center knocks loose heavy dirt and grit that they couldn't budge before. And these RED CAPS are saving us real money on our broom purchases, as well as in our cost of cleaning."

CAPITAL "Red Cap" Brooms are built for long, hard service by an organization whose entire facilities are devoted to making highly specialized industrial cleaning equipment. This explains the superiority of CAPITAL Brooms and Brushes over ordinary goods.

"Red Cap" Brooms are built in a wide metal case, nailed from each side with wrought iron nails, with an extra metal re-inforcing band and sewed with heavy waxed twine. The materials are carefully selected corn and split bamboo, all-corn, or corn and soft, round rattan.

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Industrial Brooms and Brushes

Meet Every Industrial Need

The CAPITAL Line covers practically every requirement in mill and factory brooms, push brooms, floor brushes, bench and counter dusters, railroad brooms, etc. Right now, in your plant, there is a chance to secure better results, and effect big savings, by replacing your present brush and broom equipment with units from the CAPITAL Line.



Select from Catalog 17—Then Order from Your Jobber

Catalog No. 17 illustrates and describes the entire CAPITAL Line. It is a valuable reference book for the store-keeper, superintendent and purchasing agent. Sent free on receipt of the coupon printed below. After making your selection, order from your jobber. He will fill your orders under our guarantee of absolute satisfaction, whi h permits you to return any unsatisfactory goods for full credit, carrying charges both ways paid by us.

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130 Brush Street Indianapolis, Ind.

MAIL THIS COUPON

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Send us Catalog 17, and the name of your nearest jobber.

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BYERS PIPE

GENUINE WROUGHT IRON



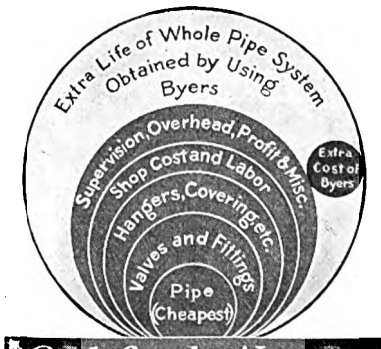
Over 30 Years' Service

Over 30 years ago, Byers Pipe was installed in these two buildings, ranking among the finest and largest of their day. In the heating, plumbing, drainage and steam systems, this pipe has served faithfully through all these years.

Pipe repairs have been negligible. The great bulk of the piping, aggregating many miles in length, most of it concealed in walls and floors, still functions perfectly. In all probability, it will continue to do so as long as the buildings remain in use.

The superior rust resistance of Byers pipe has, in recent years. become a notable and outstanding fact, especially in view of the many unfortunate experiences in buildings of more recent construction in which only slightly cheaper pipe has been installed.

In proportion to the total cost of a pipe system—the life of which depends so largely on the rust resistance of the pipe used—the extra cost of Byers Pipe is trifling.



Byers Bulletin No. 38 "The Installation Cost of Pipe" contains cost analyses of a variety of pipe systems, with notes on corrosive conditions in each. Ask for a copy.

A. M. BYERS COMPANY
PITTSBURGH, PA. ESTABLISHED 1864

New York Philadelphia Boston
Chicago Tulsa Los Angeles
Cleveland Houston

Look for the Name and Year rolled in every length

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(*Continued from page 32*)

entirely eliminate the cup problem. A good sanitary drinking fountain is an investment with guaranteed dividends.

The Wisconsin Industrial Commission requires each place of employment to be supplied with adequate drinking water fixtures and the faucets or outlets for these to be placed convenient to the employes. Individual cups must be used or sanitary drinking fountains must be installed.

The Supreme Court of Wisconsin has held that illness and death from contaminated drinking water supply in an industrial plant is an accident within the meaning of the Workmen's Compensation Act.

The Appellate Court of Indiana in a recently reported case has declared typhoid fever compensable under the Workmen's Compensation Act. The Court was of the opinion that the entering of typhoid fever germs into the workman's intestines, by reason of his drinking polluted water furnished him by the company while in its employ might rightfully be termed an accident and as such was compensable.

It is well to know that water of absolute purity is not found in nature. The purest water is absolutely devoid of taste. Distilled water is not palatable. Boiled water will make all the germs harmless, though the water may remain as muddy as ever. The palatability of boiled water can be restored by aerating it.

The best methods of purification are filteration and distillation. If no other means are available, boiling will always sterilize drinking water. The Cooper Hewitt Mercury-Vapor Lamps, used in many factories for illuminating purposes have been used successfully in the sterilization of water.

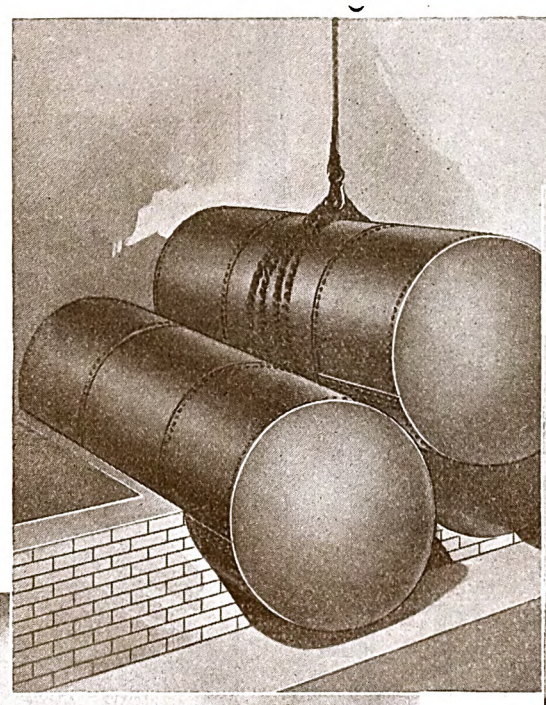
Several pharmaceutical houses manufacture preparations for sterilizing water. One that was devised by Drs. H. D. Dakin and E. K. Dunham, was used extensively during the war to sterilize contaminated water. One tablet will sterilize a quart of water. The water should be allowed to stand for thirty minutes before drinking. Fifteen cents worth of Calcium Hypochlorite, which can be purchased in any drug store will sterilize a full sixty gallons of water.

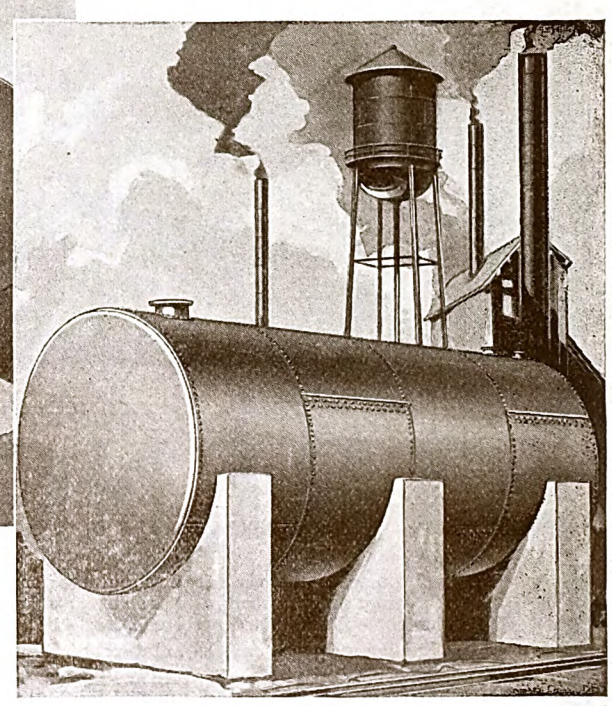
Where tanks are used much care should be given the proper construction and location.

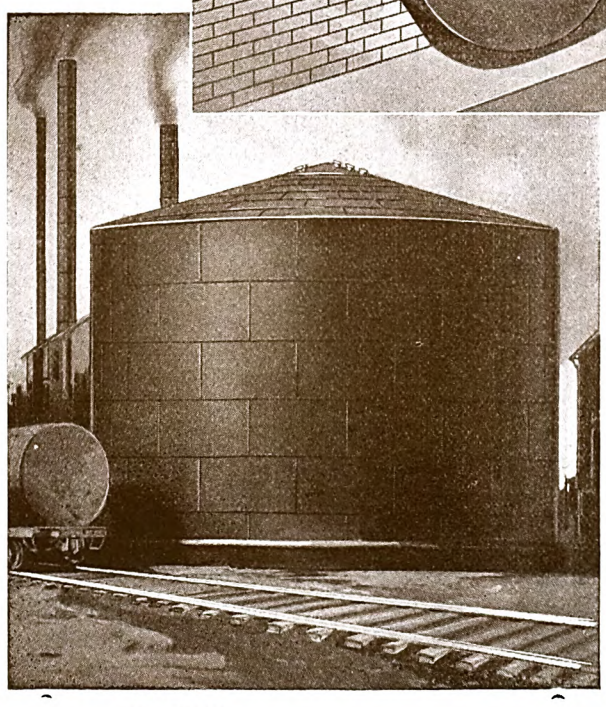
Dr. S. Dana Hubbard, superintendent, Division Industrial Hygiene, New York City Department of Health in an article recently in the "Nation's Health," says:

"In the shop the drinking water should be carefully supervised. Many instances of tank collection on the roof have shown the necessity for this supervision. Animals seeking water get drowned in these unprotected tanks and a floating carcass is not unusual to be observed by our inspectors. Sediment, especially when tanks are in the vicinity of dust producing places, collects quickly in the bottom and on the surface and either discolors or flavors the water with a

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ANY work that has been designed and built by LANCASTER is safe. If a tank, you will know that it will not leak, give way or cause damage because it has been made by men experienced in putting steel plates together into various products, who know what should be used and how it should be used and who see that all work is properly done. There is a quality of workmanship about Lancaster's tanks which stamps them as coming from a shop where men take pride in their work.

Our Service Department has compiled three books of practical value to users of Tanks. Book J-1 Prices and Specifications 303 sizes Horizontal Storage Tanks, 100 to 25,000 Gallons. Book J-2 Storage Tanks from 1,000 to 74,000 Barrels. Book J-3 Prices and Specifications of 134 Standard Sizes Pressure Tanks. Any or all of these books sent free upon request.

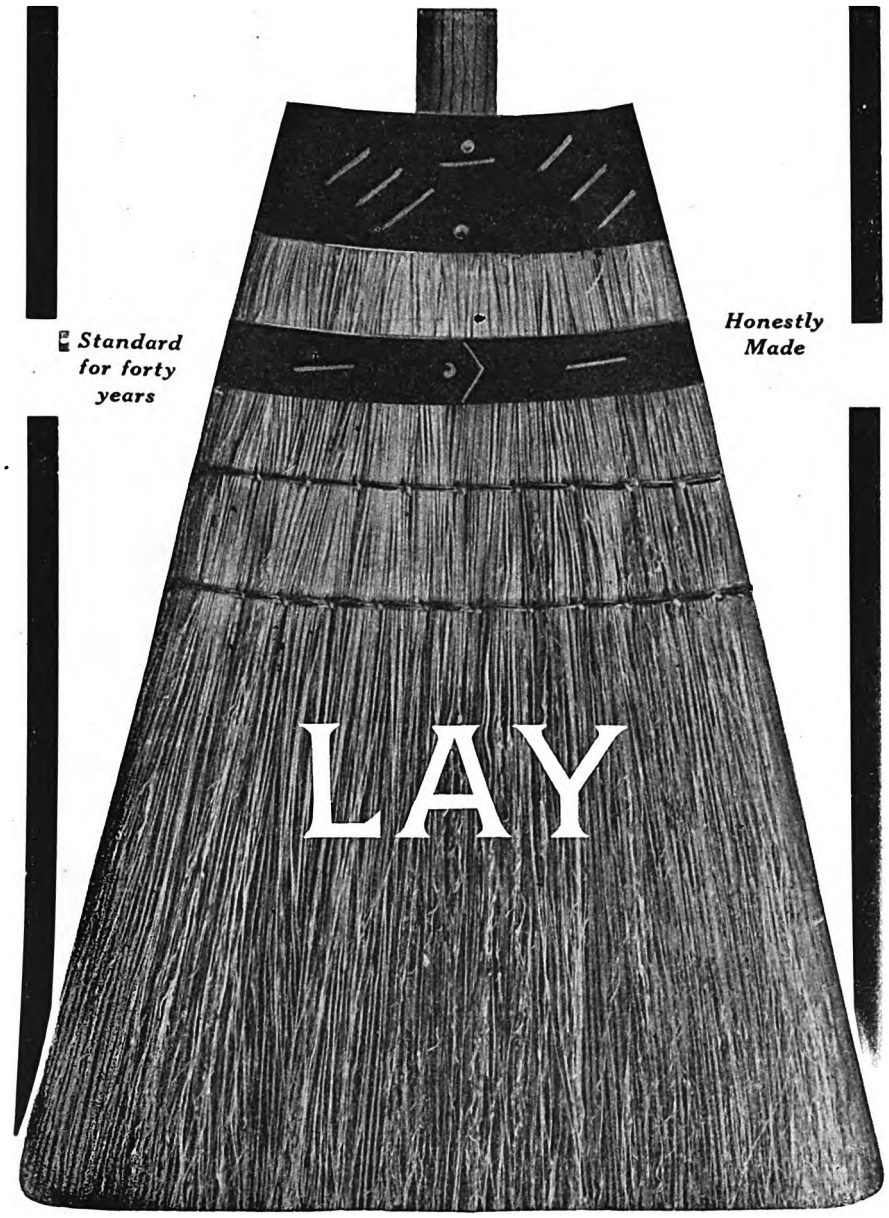
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STRENGTH

This broom will not crack at the shoulders nor shed its fibre. Knock it against heavy machinery or sharp corners and you can't hurt it. It is sturdily built for hard, long use.

The heavy metal case is a real protection against the cracking and splintering of the fibre at the shoulders. The wide case with the auxiliary bindings of metal and strong twine, keep the fibre firm and resilient during the entire life of the broom.

See how the fibre is held. No straight nails here; it's held immovable in the grip of heavy wire staples. There will be no falling fibre from this construction.

All of the materials going into the make-up of one of these brooms is of the highest grade that can be had. They are made of selected grades of broom-corn, rattan, bamboo or hickory. We stake our reputation upon the quality of each one of our products. You are perfectly safe in specifying

LAY METAL CASE BROOMS

because we guarantee them fully. For forty-six years we have been filling thousands of sweeping needs in all kinds of factories, until now we supply 90% of the Steel industries, 40% of the railroads and more than 4,000 industrials.

In addition to our metal case brooms, we manufacture a very durable line of all kinds of industrial brushes. Our long experience in the manufacture of sweeping utensils, assures your satisfaction of Lay products.

Let us prescribe for your sweeping needs. Write today for our prices.

Originators of the Metal Case Broom.

JOSEPH LAY COMPANY
120 College Street
RIDGEVILLE INDIANA



No. 256-144 Steel wire Push Broom — No. 412 Bench Brush — No. 28-H Bassine Whisk — No. 253-165 Base Push Broom — No. 3-W Steel wire Casting Brush

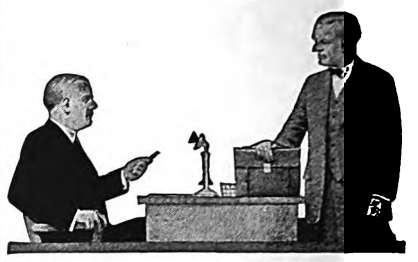
disagreeable taste. The roof of a water tank is rarely ever painted or metal protected and this cover when made, being exposed to debris gives the water a distinct "woody" taste and smell. The roof tank is also a mosquito breeder when it is uncovered. The location of the water tank is deserving of consideration as quite a number of tanks have been found located in improper places. This division is now trying to have some factories remove the water tank from water closet compartments. No doubt here, with improper ventilation the drinking water may become foul or contaminated, especially as in one instance a woman was found washing her hands in the tank after performing the function at the toilet. It seems unbelievable that a drinking water tank would be purposely placed in such locations, but where room is scarce and rents are high the propriety of such is scarcely questioned by those indifferent to the health of the worker of the community."

Some industrial managers labor under the fallacy that impure water is found only in rural communities. The Illinois Department of Health made a survey of the municipal water supplies of that state. They found of the 45.9 municipal water supplies, 77.5 per cent were good, 14.6 per cent were doubtful and 7.9 per cent were bad.

Eight years ago the water supply of Chicago was not safeguarded. Numerous cases of typhoid fever were caused by contaminated water; today the water supply is completely chlorinated and typhoid fever deaths are the lowest of any large city in the world.

From the foregoing it will be seen that illness arising from defective drinking fixtures or from polluted water is preventable. It behooves the management of an industrial plant to take the fullest advantage of methods which have been developed by sanitary enginers.

To try to save on drinking water and fixtures is to carry frugality beyond the genuine limit point of economy.



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"This is a job where delivery is paramount. And, in every case, I have made it a point to find out what kind of equipment the bidder had in order to make good his promise.

"Your Company has a piece of equipment on which I have learned to rely. I know what the PHOTOSTAT is and what it can do. I know you will not have to lose any time tracing. You can make PHOTOSTAT copies and get started on your shop work right away. In other words you'll be days ahead and I also know that there can't be any mistakes in PHOTOSTAT copies.

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Too Much Jazz

BY PHIL M. CONLEY

I JOINED a group of intelligent business and professional men recently standing in a hotel lobby. Just as I came up, one of the men, a prominent bank cashier said: "The only way you can handle labor is to starve them into submission. When a fellow gets hungry he will listen to reason."

I made the mistake of taking issue with his remarks. I asked: "Have you forgot your history that gave the causes which led up to the French Revolution? Have you read Napoleon's statement that he never liked to fight a hungry army? Do you remember the story of Runneymede where the English people forced King John to grant Magna Charta because he tried to starve them into submission? Do you recall the history of our own United States when King George III tried to starve the colonists into submission and as a result the American Revolution freed us from the mother country?"

My questions were not answered. They did not seem to interest either the banker or the other men in the group. The banker informed me that we were dealing with present day conditions, an age of machinery, which had no relations to history or times that were entirely different in spirit and import. The general attitude of the group was that labor must be dealt with in a stern manner. It was a war to the last ditch. And one of the strategic moves in any war is to cut off the food supply.

I sat with a committee recently which had for its object the working out of a plan to settle a strike and to kill the influence of labor union activities. A clever lawyer who had fought many legal battles for employers and corporations addressed the committee: "Gentlemen, the only way we can effectively curb the activities of the union is to secure an injunction against the members picketing, and prevent them interfering with the workmen we employ. As soon as the injunction is issued we can have the leaders arrested and before they are released the strike will be broken. Then, gentlemen, we will frame an industrial act for the legislature that will do away with labor unions in this state."

I did not comment. What I wanted was the point of view of the progressive business men in the group who accepted this brilliant attorney's advice. They thought he was original. At least they kidded themselves into thinking his plan was new in order to patch up their difficulties so they could resume work. It seemed their only thought was to get back to work at any cost.

They did not concede even to themselves that the plan proposed had been tried many years with disastrous results to employers and to industry. The spirit of war was the attitude of the committee. And the only military tactics the general, their attorney, knew was to fight with legal procedure.

I have just finished reading a lengthy report made by a committee of ministers who attempted to investigate a difference between a group of employers and employes. It contained some information and a great deal of misinformation. Before I was half through I concluded the divines had more sentiment than sense. I was forced to the conclusion that professional spiritual leaders should stick to their jobs.

The report would have us believe that never before have people suffered, and that laboring men have never been subjected to unpleasant conditions. They overlooked the fact that suffering and misery have existed ever since the world began. However, this is no excuse for continuing poor conditions for the laboring man in this generation.

But if the ministers had made an impartial, intelligent investigation, without prejudice and without sentimentality as their inspiration, they would have reported that conditions were not what they should be, but that they were infinitely better than they were a few years ago and that they were continually being improved. They would have



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found more humanitarian treatment on the part of employers of today than has ever existed in the history of the world.

I have read numerous magazine and newspaper stories recently relative to the so-called problems in industry. Many of them have been amusing on account of the serious intent of their authors. They give the impression that they have discovered something and that unless their opinions are accepted immediately the world will be lost.

For the most part these stories have been interesting. They have been written for public consumption, and in order to interest the public, stories must be news of a more or less sensational nature. But it must be conceded that it is impossible for a person to go into a coal field and make a three day investigation then write a story covering the entire situation and give intelligent suggestions concerning ways and means of correcting the difficulties of the labor troubles.

The press has done a great deal to inform the public concerning this matter. But journalists cannot solve the labor problems. They do not know labor conditions except as they are told about them. Manifestly they want to be fair, but they are human beings and their point of view is shaped by the opinions of the people with whom they talk.

Some trained professional men have gone into shops, mines and mills; worked as laborers; and then reported verbatim conversations they have had with workmen. They have given detailed descriptions of conditions as they have seen them. Very interesting. But the whole procedure reminds one of Empey's "Over the Top" book. He described one sector, and that a small one, of the battle front.

I have read magazine articles and books written by these temporary laborers. I confess I have been disappointed. While they honestly attempt to point out the many sides of the question, they fail to give a solution. I remember the five years I spent in a machine shop earning my daily bread. The stories told by these volunteer workmen have not impressed me. They are merely narratives of surface conditions.

Practically every week some enthusiast in Congress decides that he will settle the whole matter between capital and labor. He either proposes a law or an investigation. Newspapers carry excerpts from his speeches and his full comments are placed in the Congressional Record. Some of his constituents read about his efforts and comment that he is doing good work for his country. Then when he is up for re-election, he refers to the wonderful record he made in Congress.

An investigating committee from Congress is frequently appointed. It works for at least a week hearing testimony, all of which is compiled in an elaborate report. After a lot of talk, some of which reaches the newspapers; the report is filed. Still the problems of industry remain unsolved.

(*Continued on page 41*)



KEEP your grounds clean—for conditions "without" your plant are taken as an index of the management and product "within."

Put up a clean-cut, business-like Anchor Post Fence—sturdy, unclimbable, impregnable. Prevent others from making your property a dumping ground or "hang-out." Provide unfailing protection against sneak thieves, night prowlers, and all other trespasser dangers.

Call in an Anchor Post Fence Specialist. He'll have complete information on just the fence you need. For quick service, write, phone or wire the nearest Anchor Post office or sales agent.

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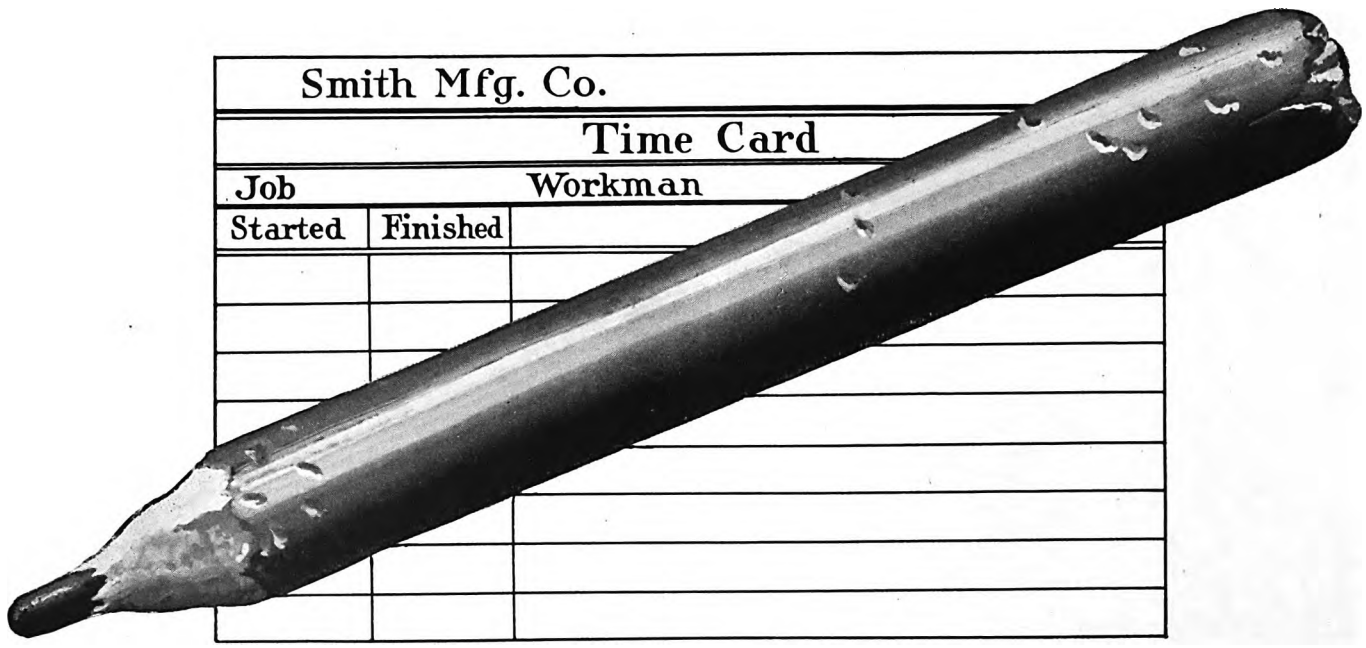
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FIRM—BECAUSE THEY ARE ANCHORED

Anchor Post Fences

PERMANENT—BECAUSE THEY ARE GALVANIZED

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How many of your time records are kept with this pencil stub?

ARE you still using the old pencil and paper system of keeping the time on each job? If you are, it's a ten to one bet that your cost records are inaccurate.

Machine operators are poor time keepers and always will be. Their interests are centered in other matters. And when a job is finished they guess at the time which it took. Those guesses go to form the basis of all your cost data if you are allowing each operator to figure his own time.

Why persist in letting your mechanics guess at the time each job takes? Why not install a machine that records the elapsed time by a simple pull on a lever?



The Calculagraph is a spring-driven machine free from the wiring troubles of electrical time recorders. It stamps the starting, stopping and *elapsed time* right on the job ticket.

It eliminates all errors on the part of the operator. He no longer guesses. The printed record is there as proof.

It saves the time of cost clerks. They no longer need to subtract starting from stopping time. The *elapsed time* can be read direct from the job ticket.

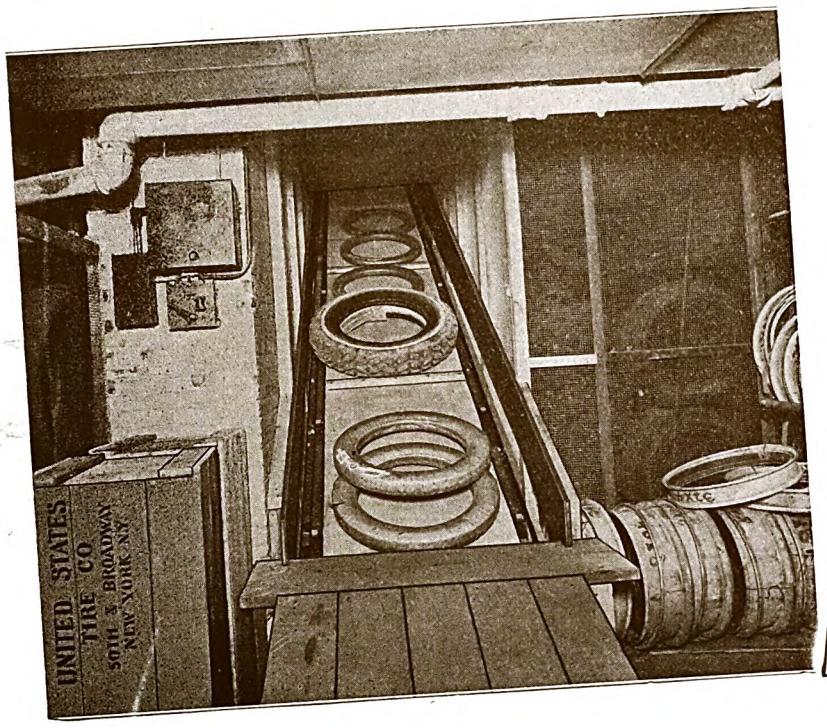
Any number of workmen can use one Calculagraph. A backward-forward movement of the right hand lever when the job starts, a pull of the left hand lever when the job is done, and the time record is complete.

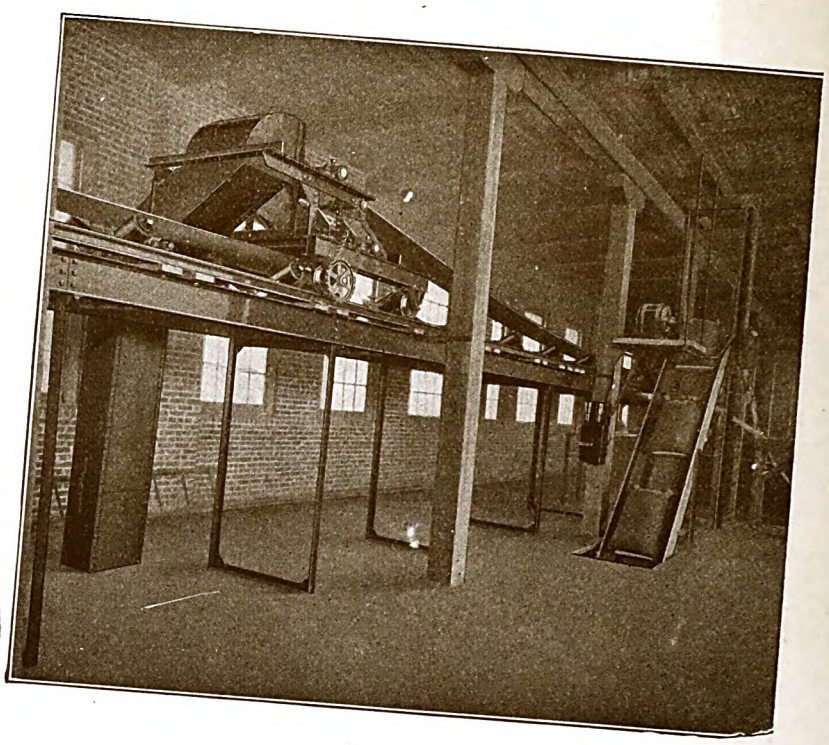
Send for our booklet "Elapsed Time Records" today. It will interest you.

THE
CALCULAGRAPH
THE ELAPSED TIME RECORDER

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How does your present production compare with that of a year or six months ago?

If your production remains about the same it is very likely that you are dis-satisfied with the status of your business. If this is the situation production should be increased because genuine prosperity is the result of maximum production—smaller unit profits and increased sales.

A Conveying System not only increases production but it is the means of controlling it. Your present equipment plus a Conveying System designed to meet your individual conditions will yield a production far in excess of that which you are producing at present.

Conveying Systems to function properly must be designed to meet specific requirements. This requires making a survey of your plant, studying your operations, determining desired production so that data can be secured which will enable us to design a conveying system which will enhance your production.

Adequate production will make your business prosperous. Lose no time. Communicate with us at once. Write us immediately advising time convenient to confer with our engineers.

SAMUEL OLSON & CO.

Loose, Bulk and Packed MATERIAL HANDLING SYSTEMS

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CHICAGO, ILLINOIS

202 5th Ave.
NEW YORK, N. Y.

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(*Continued from page 38*)

There is too much jazz on the subject. There are too many "quacks" trying to prescribe for an ailment about which they know nothing. There are too many "shyster" lawyers arguing the case. There is an attempt to clutter up the over crowded law books with statutes designed to settle this matter, all the time forgetting that laws cannot adjust human relationships.

If I were to tell the bank cashier how to run his bank, he would think I was a fool. If I were to offer suggestions to the lawyer about how to argue his cases, he would bow me out of his office. And the same would be true of the other business and professional men who are interested in this great factor in our economic life. They mean right, but they are ignorant of the fundamentals of the subject.

In my opinion, and I am possibly adding another jazz note to this much jazzed subject, I think that the industrial subject should be left to the men who are professionally trained and capable of handling it. They are face to face with the situation; they understand conditions; they are not theorists or dreamers; they are actors.

If I had a tooth that needed attention, I would not go to a blacksmith. And most assuredly if I had an industrial problem to meet I would not go to someone who knows nothing about the subject.

Putting Coal on the Wire

(*Continued from page 11*)

barges on the river to the bunkers from which the coal flows by gravity into chutes connecting with the automatic stokers on the floors of the boiler rooms. The coal handling force consists of the tower engineer, his assistant, a tripper, a weigher, and two men in the barges.

We have followed the coal to the automatic stokers. There, by a series of reciprocating plungers, an evenly regulated and unbroken supply of fuel is forced into the firebeds of 146 water tube boilers. These giants, each of 650 horsepower, 200 pounds steam pressure, and 100 degrees superheat, are arranged in batteries of six, back to back. the operator of a private power plant, or any other man really interested in the production of steam, could feast his eyes for days upon days in the boiler rooms of Waterside and then not get his fill. It is hardly feasible therefore, to attempt here a detailed description of those rooms.

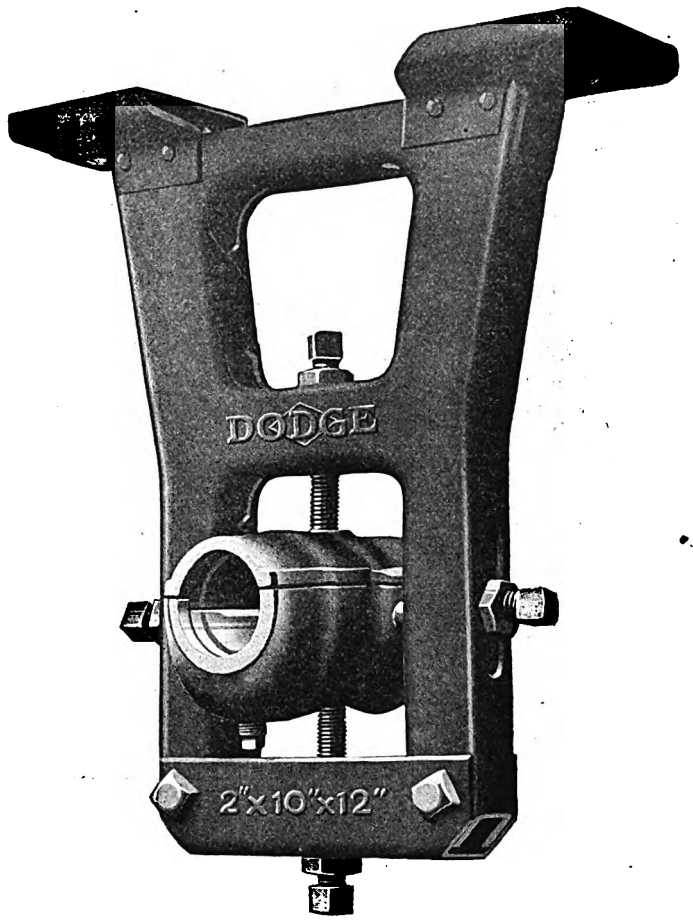
Three features may be cited as typical of the improvements constantly being made to raise the efficiency of the central station. Perhaps the most important of these is the centralized air control system which enables one man, the boiler room engineer, in Waterside No. 2 to control the air for all 92 boilers in the building; and the engineer in Waterside No. 1 to govern from one point the air for the 54 boilers in that building. Prior to the installation of this system, one man on each battery of six boilers controlled the air for his battery. Disregarding entirely the saving in man-power effected by the change, it is easy for anyone at all familiar with the importance of the air factor in steam generation and with the necessity of keeping steam pressure steady in an electric power generating plant to appreciate the great stride toward uniformity made by the change from local to centralized air control.

Then there is a signalling system, an ordinary carriage call electric sign such as is seen outside any theatre, which tells the boiler room engineer throughout the day and night how many boilers it will be necessary for him to have in operation in the next half hour in order to take care of the rising or falling electrical load. This device is controlled by the System Operator's Office, an extremely important development in central station operation concerning which more will be said later.

A third improvement, the results of which are apparent, even before one enters the building, from a glance at the smokestacks towering 300 feet above Waterside, is a cinder catcher which removes 93 per cent of the solids that formerly went up into the air. The smoke from Waterside today is practically cinderless and colorless.

(*Continued on page 43*)

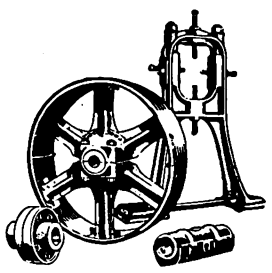
A Pressed Steel Hanger guaranteed by DODGE



"THERE is a practical hanger" is the opinion of experienced millwrights who examine this popular addition to the Dodge line of power transmission equipment.

It is light—strong—safe—easy to erect—unbreakable and low priced. Two years of careful experiment is embodied in its design and construction—it has withstood tests far more severe than any that will ever be encountered in regular line shaft service.

Dodge steel hangers are guaranteed by Dodge Quality which has been recognized for over forty years as an assurance of low first cost, low upkeep expense and continuous trouble-free performance.



Buy Dodge steel hangers as well as pulleys, clutches, couplings, collars, etc., from your local dealer on the immediate delivery basis.

DODGE

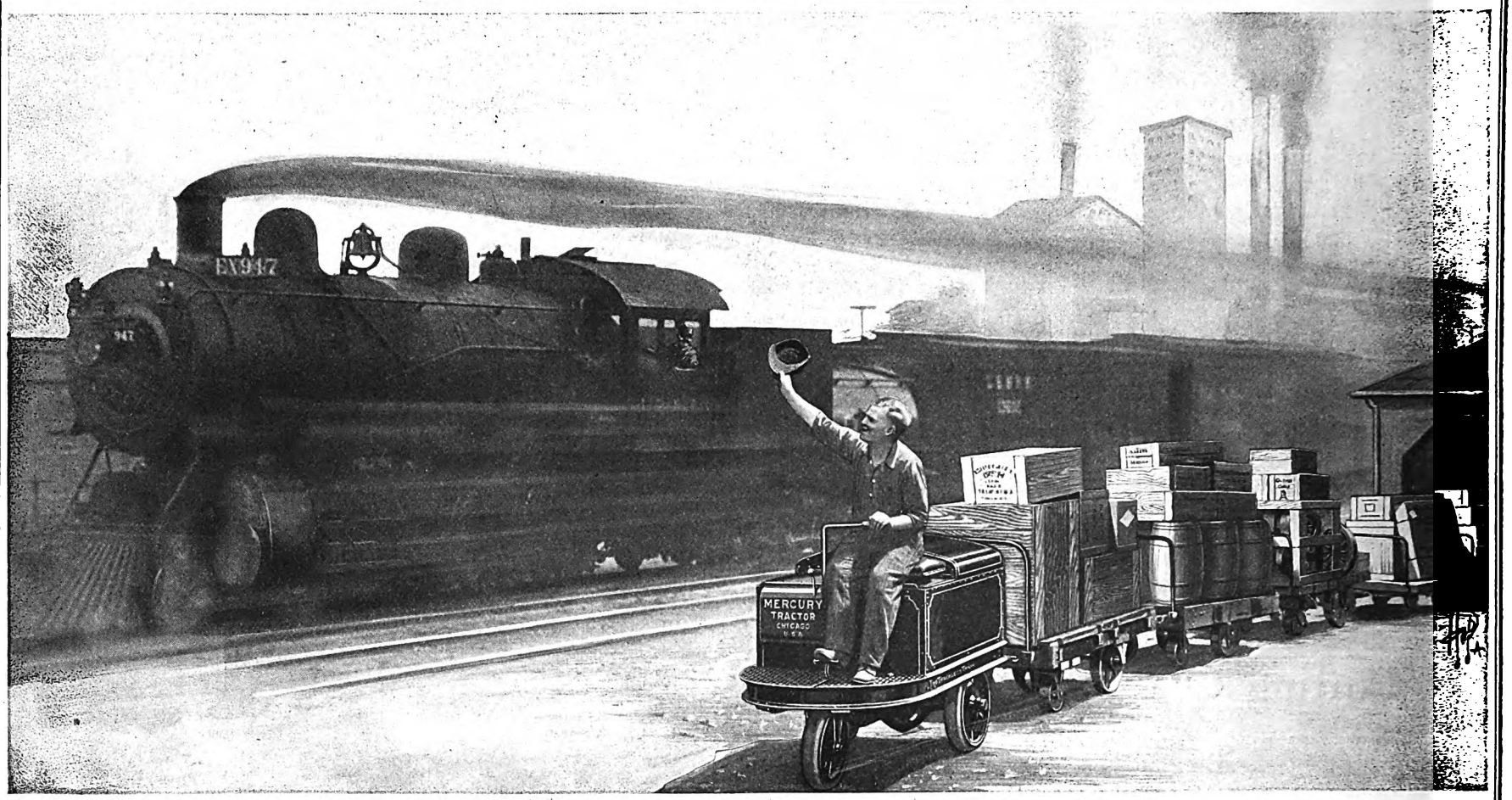
Power Transmission Machinery

DODGE MANUFACTURING CORPORATION

General Office: Mishawaka, Indiana; Works: Mishawaka, Ind., and Oneida, N.Y.

New York Boston | Philadelphia Pittsburg | Cincinnati Houston | Chicago St. Louis | Atlanta Minneapolis | Seattle San Francisco | Newark Oneida

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"COMRADES OF PROGRESS"

"THE TRACKLESS TRAIN" is the materials-movement system based on the principles of the steam railroad—transportation principles which have withstood the test of time for over an hundred years.

These principles are in brief:—The motive unit, being separate from the train, works continuously and wastes no time loading and unloading at terminal points. The power unit utilizes to the fullest its ability to work by pulling its burden instead of carrying the burden on its back.

Correct in principle and possessed of the further advantage of being unrestricted to a fixed track or path and able to go anywhere a man can push a hand truck; "The Trackless Train" is beyond question the most efficient known method of freight-house, warehouse and industrial plant transportation.

As originators of the system we offer the services of an experienced consultation staff and manufacture the equipment. Write for descriptive literature or request us to have a representative call.

Mercury Manufacturing Company

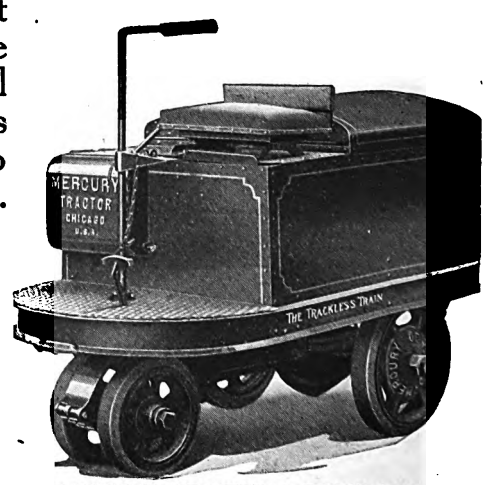
CHICAGO **U. S. A.**

A partial list of Mercury customers all of whom operate FLEETS of Mercury tractors. (Note: A fleet in this instance indicates not less than five machines.)

American Railway Express Company
American Radiator Company
Armour and Company
Illinois Glass Company
American Window Glass Company
Kewanee Boiler Company
General Electric Company
American Sheet & Tin Plate Co.
Endicott Johnson Company
National Malleable Castings Co.
Standard Oil Company
Wilson & Company
Union Stock Yards & Transit Co.
Brooklyn Union Gas Company
Pennsylvania Railroad Company
Southern Lumber Company
Firestone Tire & Rubber Co.
Proctor Gamble Company

The Mercury tractor is built in five distinct types and fifteen different models. There are twenty-five kinds of trailers to meet the usual requirements and we design special trailers when necessary. No matter what the job there is a Mercury equipment to handle it.

Sears Roebuck & Company
Illinois Central Railroad
Miller Rubber Company
New York Central Railroad
United States Government
Goodyear Tire & Rubber Co.
Morris & Company
Studebaker Corporation
Trumbull Steel Company
Philadelphia & Reading R. R.
Sugimura Warehouse (Japan)
Compania Terminal Atares (Cuba)



THE FAMOUS MERCURY "L-TWIN" TRACTOR

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(*Continued from page 41*)

The construction of this cinder catcher is simple. A sheet-steel baffle plate, over which water is constantly flowing, stands in the way of the smoke coming from each of the 146 boilers; as the cinders in the gases or smoke hit the baffle the water carries them to the bottom of a horizontal tube from which they are washed into a scow every 24 hours. It is worthy of note here that the process of removing ashes at Waterside, also, is entirely automatic. From the fire beds the ashes drop into hoppers which in turn are emptied into collectors drawn by storage battery locomotives. These cars deposit the ashes into a pit, from which a conveyor lifts them to a storage bin from which they are dropped into dumping scows.

Our digression from the immediate process of putting coal on the wire was at the point where a battery of boilers, aggregating 95,000 horse-power, daily converts 2,500 tons of coal into sufficient steam to drive what is probably the most powerful battery of turbine generators in America. There are ten turbine generators in each of the two buildings at Waterside, one building housing: one 31,000 kw. horizontal, one 22,000 kw. horizontal, two 14,000 kw. vertical, and six 12,000 kw. vertical, and the other holding: two 35,000 kw. horizontal, three 20,000 kw. horizontal, three 9,000 kw. horizontal and two 7,000 kw. The operation of the turbine generators in each building is directed from a gallery extending into the generating room and affording an unobstructed view of each machine. The two plants are operated as a single unit under the control of the System Operator.

The turbine generator is the point at which coal, in the form of steam is actually placed on the wire as electrical energy. But the current which comes from the generator is not quite ready to light your lamps or lift your elevators. Before it is ready for distribution to the consumer, it must first pass through three distinct channels, each a cog in the big central station machine as important as the generation of the current itself. These channels are: first, the cables carrying the current at high tension to the 38 distributing or sub-stations; second, these stations, themselves, whose job it is to transform the high tension alternating current into direct current at low voltage; third, the intricate system of street feeders and mains by means of which the "juice" is conveyed to the lines which run into the consumer's premises.

A word about each of these channels. Cables from the turbine generators conduct the current, which at that stage is either 6,600 or 11,000 volt stuff, through three single-phase reactors; these are huge safety devices to limit or restrain the high tension current in the event of a short circuit. From the reactors the current is carried through a series of oil circuit breakers to the great busses or "carry-alls" on which are hooked the lines that carry the current to the sub-stations.

The current, received by the



"Mercury" Proud of Timken Bearings

Timken Tapered Roller Bearings are standard equipment in Mercury industrial tractors.

In a letter to The Timken Roller Bearing Co concerning the installation of Timken Bearings in their product the Mercury Manufacturing Co. says:

"Your product has stood up exceptionally well in the hard service which our tractors are forced to undergo.

". . .We have always been proud to point out that our bearings are 'Timken Tapered Roller'.

"Our customers and prospects have accepted our bearing specifications with full confidence and without question."

Here is sharp realization of the fact that in addition to their efficient performance Timken Tapered Roller Bearings are a distinct sales asset to any product in which they are installed.

The Timken Roller Bearing Co
CANTON, OHIO

TIMKEN
Tapered
ROLLER BEARINGS

© 1922, T R B Co, Canton, Ohio

—*Will Also Save Power and Money in*—

Blowers and Compressors
Clay Working Machinery
Cranes
Dairy Equipment
Electric Motors
Electrical Machinery
Elevator Drives
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Gasoline Rail Cars
Gas Motors
Gas Producers
Grain Milling Machinery
Grinders
Hoisting and Conveying Machinery
Industrial Tractors and Trucks
Laundry Machinery
Lawn Mowers
Machine Tools
Mine Cars
Mining Machinery
Oil Well Machinery
Paper Making Machinery
Power Transmission Machinery
Printing Presses
Pumps
Railway Equipment
Refrigerating Machinery
Road Making Machinery Wheels
Separating Machinery
Shoe Machinery
Steel Mill and Foundry Equipment
Stokers
Street Railway Cars
Street Sweepers
Textile Machinery
Tire Making Machinery
Ventilating Machinery
Wood Working Machinery

—*and Wherever There Is Friction*

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We Ought to Know

We've spent over thirty years building tanks for all sorts of uses. Our engineers, designers and workmen are constantly thinking tanks. Our products are living up to their reputation in all parts of the country.

The Caldwell Steel Tank is like our other products in that it reflects all the excellence of character that such experience produces. You can rely upon it for unusual performance.

Send for Catalog

W. E. Caldwell Co.
Incorporated
2200 Brook St. **Louisville, Ky.**

Caldwell TANKS AND TOWERS

CAMBRIDGE ELECTRICAL CO_2 RECORDERS INDICATORS

Accurate Boiler Room Records

without the use of rubber, glass or chemicals, will prove a boon to your operating man in the power plant.

The Cambridge CO_2 Recorder-Indicator is entirely electrical—Accurate and Rapid in action and can be placed any distance from the flue.

Low in Maintenance Cost.



Send for List No. 157X

Other Cambridge Instruments

Electrical Distance Thermometers
Resistance Pyrometers
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Optical Pyrometers
Radiation Pyrometers
Electrical Instruments
Physical Instruments

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC.)
Works Ossining-on-Hudson NEW YORK Office & Showroom Grand Central Terminal

sub-stations at 6,600 or 11,000 volts is passed through transformers which bring it down to 200 volts, then through rotary converters which reduce it to low tension or 120 volt direct current. Each sub-station is equipped with a storage battery installation capable of carrying the entire load of the station for a period of from five to seven minutes, though the emergencies for which the storage batteries are provided rarely extend over one minute.

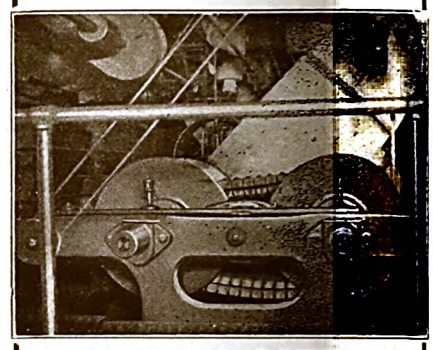
Just as only a handful of consumers—the city high pressure pumping station, an electric railway system, and the large industrial plants using high tension current—receive their power direct from the generating station, so only the large department stores, office buildings and the other heavy consumers of direct current are served direct from the sub-station's switchboard. The lines which provide light, heat, and power, for the great mass of The New York Edison Company's customers are connected to underground mains which in turn are fed from the street feeder boxes located at strategic intersections, the feeder boxes receiving current direct from the sub-stations. The feeder box system does two important things: reduces greatly the mileage of underground cables, and facilitates automatic equalization of the voltage in cases of breakdowns or sudden changes in the consumption of current.

The nerve center, not only of the Waterside plant, but of the entire New York Edison Company system is the System Operator's Room at Waterside No. 1. Upon the System Operator rests the responsibility for the maintenance of service to the sub-stations throughout the city. He must anticipate every demand for service and give the orders which will enable the system to meet it. On the big board before his desk colored lights indicate the condition of every generator and every transmission line; meters show the capacity of the entire system and the current transmitted on the various feeders; a gauge shows the boiler pressure. Behind him a wireless gong signal apprises him of approaching storms and their accompanying darkness long before a cloud is in sight from

(*Continued on page 46*)

"The Reeves"

VARIABLE SPEED TRANSMISSION



Installation of a No. 6½-E REEVES Transmission operating stoker shaft at New York Edison Co.

Variation of speeds easily and quickly obtained

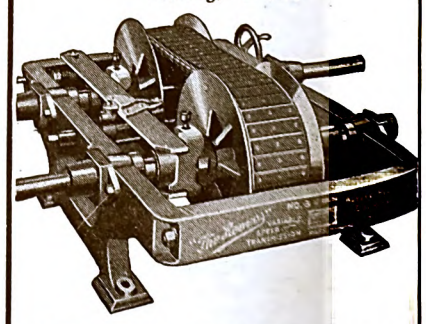
Application to stokers in lighting and power stations makes it possible to anticipate heavy loads and to take care of sudden "peaks."

By regulating the speed of stokers through "The Reeves" Variable Speed Transmission, precisely the right amount of coal is fed into the furnace at all times, assuring perfect combustion and securing the greatest amount of heat units per ton of coal.

A slow or normal fire can be maintained until there is a call for more power, or when a dark storm is approaching, then the speed of the stoker is increased by means of "The Reeves" Transmission, until the proper amount of coal is being stoked to produce the necessary power.

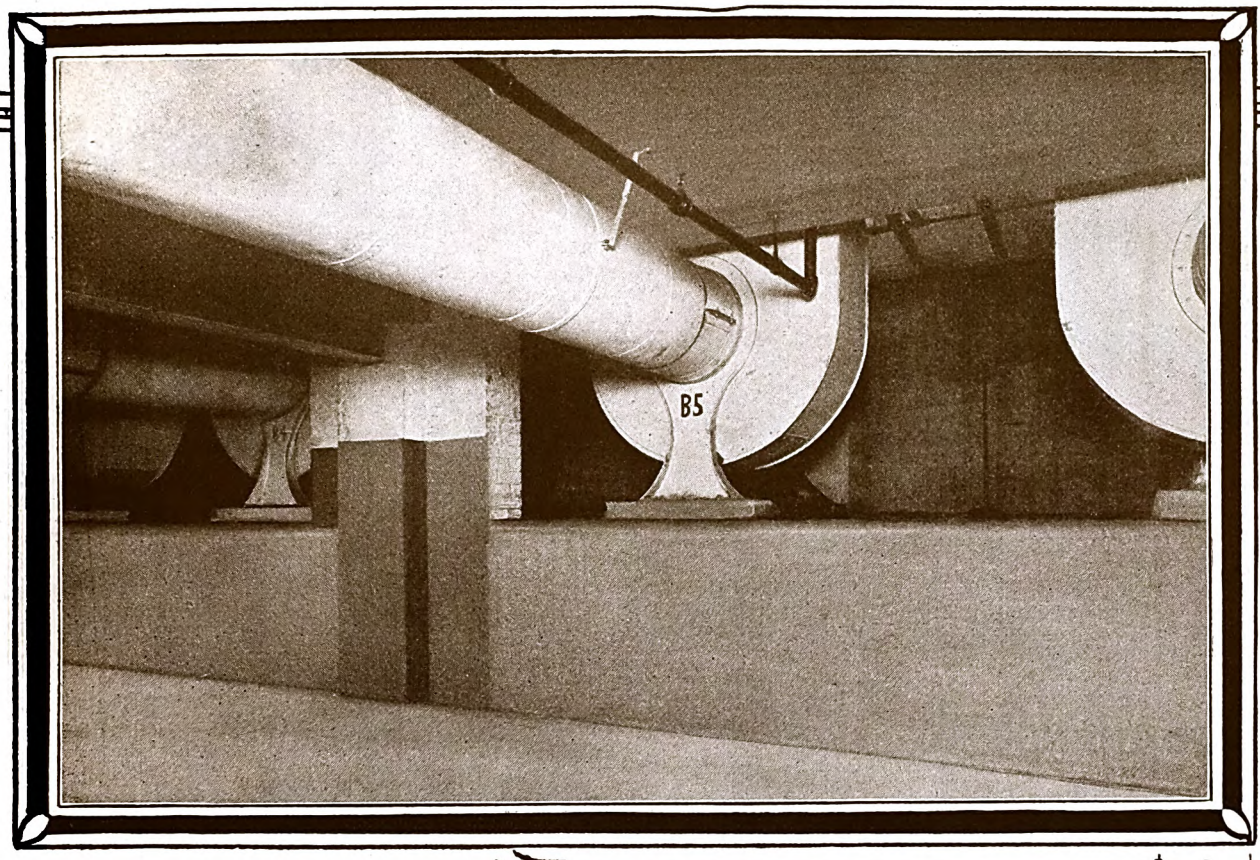
The original installation of "The Reeves" Transmission made with the New York Edison Company was in 1912. This machine was subjected to a rigid experimental test, which proved that it effected such great saving in coal that it paid for itself in an incredibly short time. The performance of this machine has resulted in the installation of a great number of REEVES Transmissions with this company.

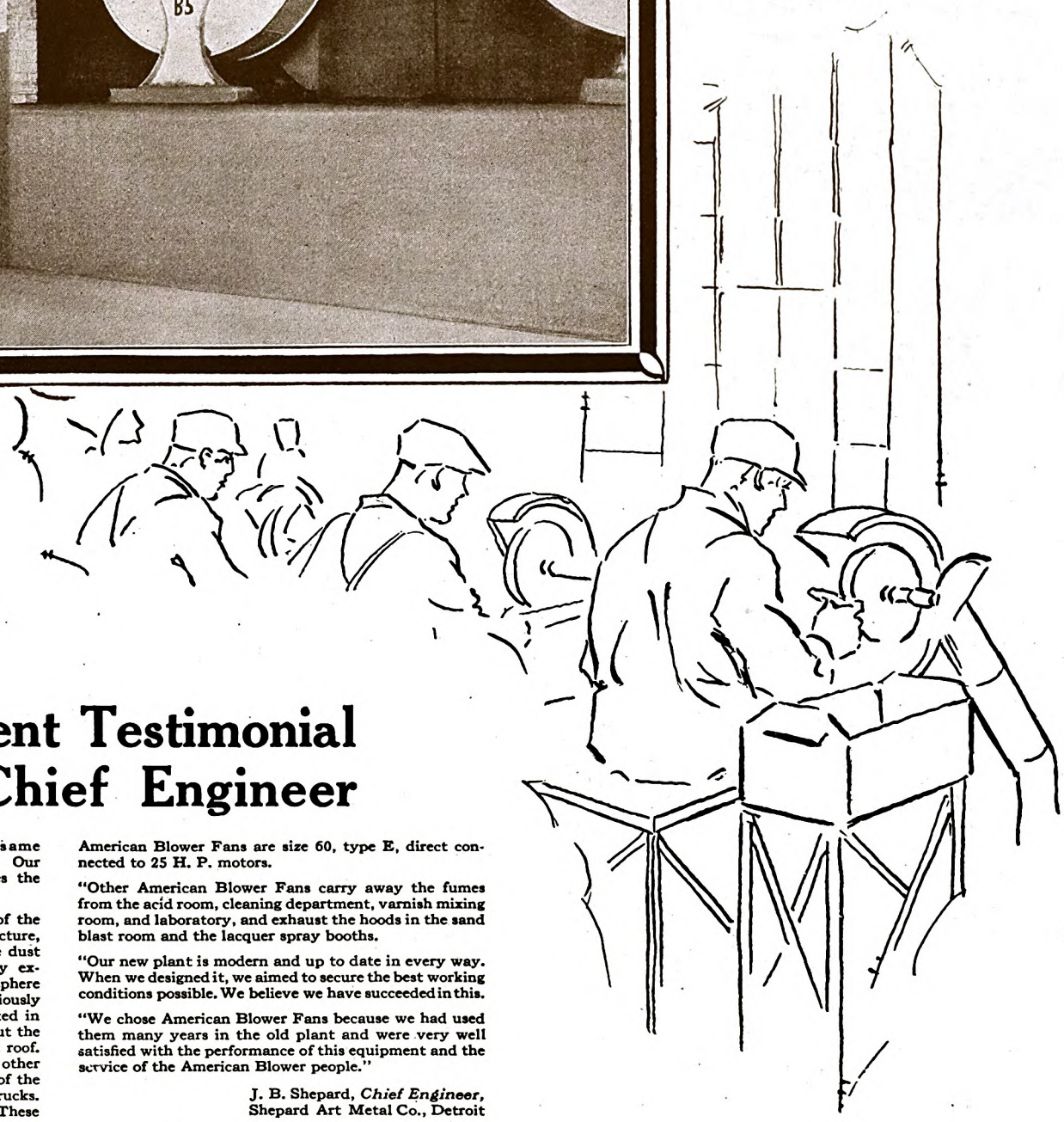
Write for our new 52-page catalog, L-44.



REEVES PULLEY CO.
Columbus, Indiana

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An Eloquent Testimonial From a Chief Engineer

"When 256 polishers are working in the same room, the problem of removal is a big one. Our American Blower Equipment, however, does the work perfectly.

"For putting a high polish on the plated parts of the articles of automobile body hardware we manufacture, we use polishing wheels and emery powder. The dust arising from this operation must be completely exhausted, because if it should enter into the atmosphere breathed by the men, their lungs would be seriously effected. Our eight American Blower Fans, located in the basement, below the Polishing Room, draw out the dust and force it into four dust collectors on the roof. From these dust collectors, it is blown by two other American Blower Fans to a collector at the rear of the building, from which it is hauled away by motor trucks. Three motor truck loads are taken away per week. These American Blower Fans are size 60, type E, direct connected to 25 H. P. motors.

"Other American Blower Fans carry away the fumes from the acid room, cleaning department, varnish mixing room, and laboratory, and exhaust the hoods in the sand blast room and the lacquer spray booths.

"Our new plant is modern and up to date in every way. When we designed it, we aimed to secure the best working conditions possible. We believe we have succeeded in this.

"We chose American Blower Fans because we had used them many years in the old plant and were very well satisfied with the performance of this equipment and the service of the American Blower people."

J. B. Shepard, *Chief Engineer*,
Shepard Art Metal Co., Detroit

American Blower Engineers will cooperate with you in the selection of equipment for exhausting, heating, ventilating, mechanical draft or any similar purpose. Write for bulletins on any of the above subjects.

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

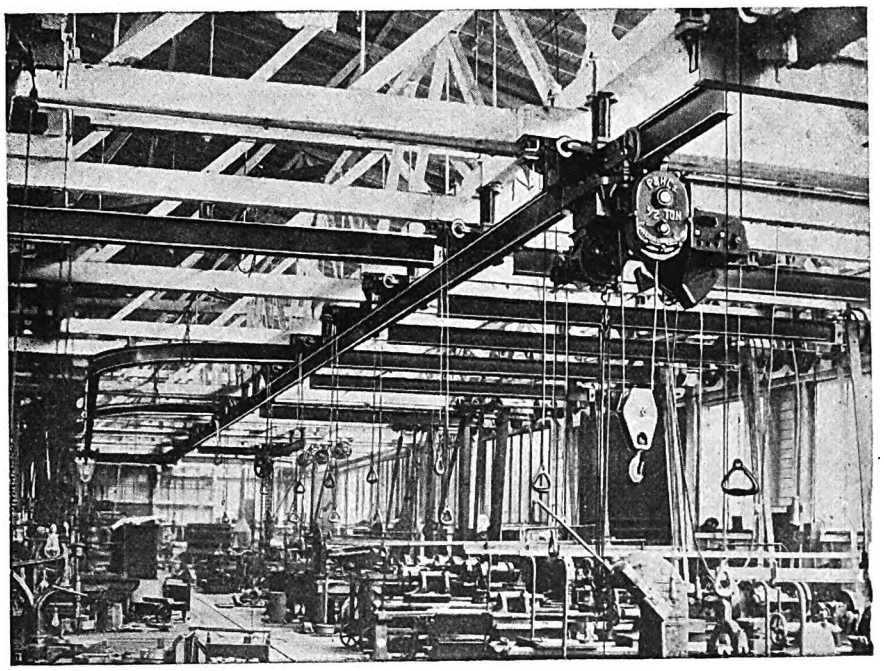
(244)

American Blower

"Sirocco" TRADE MARK

EXHAUSTERS · VENTILATING FANS · AIR WASHERS · BLOWERS · ENGINES
FOR HEATING, VENTILATING, DRYING,
AIR CONDITIONING, MECHANICAL DRAFT

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Are You Economizing on Productive Floor Area?

You can make greater use of available floor space, decrease the aisle areas—and at the same time reduce your common labor costs by means of P & H Overhead Hoist and Monorail Systems.

In the installation shown above—at the Summer Iron Works the P & H eliminates hand trucking and speeds up the carrying of material from one machine or location to another.

The Hoist travels on the main track or on spurs—pivoted I-beam sections being placed at intervals to allow the Hoist to give service wherever required.

This installation has been pointed out by a material handling engineer as typical of modern labor saving methods. There is no loading and unloading of trucks traveling over valuable floor space—no unnecessary gang of laborers.

The same quality of design and construction found in P & H Traveling Cranes, is applied to P & H Hoists. Long life, low maintenance, accessibility and dependability are the result.

P & H Electric Hoists and Monorails can relieve you of labor problems, and help care for increased production. It costs you nothing to let us look over your shop layout and give you an estimate on your requirements.

Readily Installed in Existing Buildings

You can equip your present buildings, sheds, or yards with P & H Hoist and Monorail System at once, extending their use at any time. Hoists of various capacities, floor or cage controlled, can be applied depending on the work to be accomplished.

As the major or as auxiliary to traveling crane service, the P & H Hoist with its superior rugged design and construction, and its low maintenance will earn its cost in a short time.

These Features Mean Better Hoist Service—Lower Maintenance

P & H Hoists have these outstanding features—all important from the users' standpoint:

Simplicity—accessibility—rugged control—spur gear transmission with hoist gears running in oil.

Crane and Hoist Division

PAWLING & HARNISCHFEGER CO.

Established in 1884

3850 National Ave., Milwaukee, Wis.

New York, Pittsburgh, Phoenix, Los Angeles, Salt Lake City, Chicago, Philadelphia, Denver, San Francisco, Portland, St. Louis, Birmingham, New Orleans, Seattle, Atlanta

P&H HOIST AND MONORAIL SYSTEMS

(*Cntinued from page 44*)

any point in New York City. Immediately in front of him, at his desk, the System Operator has direct telephone connection with 80 men. At his left, a telegraphic signal system, similar to that used by municipal fire departments, enables him to give any message simultaneously to any four or more —or to all—stations in the system. Through this room, also, the lines of The New York Edison Company are connected with those of The Brooklyn Edison Company, and those of every other big nearby central station. The efficiencies made possible by such a nerve center are patent.

The wireless storm detector is a comparatively recent development. Prior to its invention it was customary at Waterside to have a man stationed on the roof of the building the greater part of the day on the lookout for signs of storms.

Electricity, like light and sound, is not a physical material and therefore exists only so long as the influence of its generating source continues. This condition makes it impossible to store electricity in large quantity for emergency use. At times of light or average load, a steam driven electric generating station naturally has a large share of its boilers banked and a number of its generating units idle. The rapidly moving clouds which accompany a storm constitute the principal cause for sudden increases in the demand for current. A big cloud looms over Manhattan, and a hundred thousand persons push the button. But the storm detector told the System Operator that clouds were headed this way an hour ago, and so the hundred thousand circuits serving more than 3,000,000 persons get their lights instantaneously and as bright as ever.

The storm detector is made up of the following parts: an aerial, a short circuiting switch, a spark gap, a coherer, a relay and battery, a condenser, and a ground connection. On page 11 is a diagram of the connection of these parts.

A recent writer in INDUSTRY ILLUSTRATED made the statement that as one goes more deeply into the subject of industrial power plants he is im-

(*Continued on page 48*)

COAL Preparation



"Pennsylvania" Bradford Breaker

WHAT DOES TRAMP IRON DO TO YOUR COAL HANDLING MACHINERY?

"Pennsylvania" Bradford Breakers and Hammer Crushers automatically and accurately pick out the tramp iron during the crushing operation, preventing damage to crushers, and stokers, without extra power or upkeep.

In addition, "Pennsylvania" Bradford Breakers automatically remove the harder impurities including slate, bone, rock sulphur balls and mine props, together with the tramp iron, while preparing Bituminous coal for Stokers, By-Product Coking, Gas Making and preliminary to pulverization for Powdered Fuel Plants.

We have brought the right solution to many coal preparation problems, and are ready to cooperate, on receipt of your suggestion.

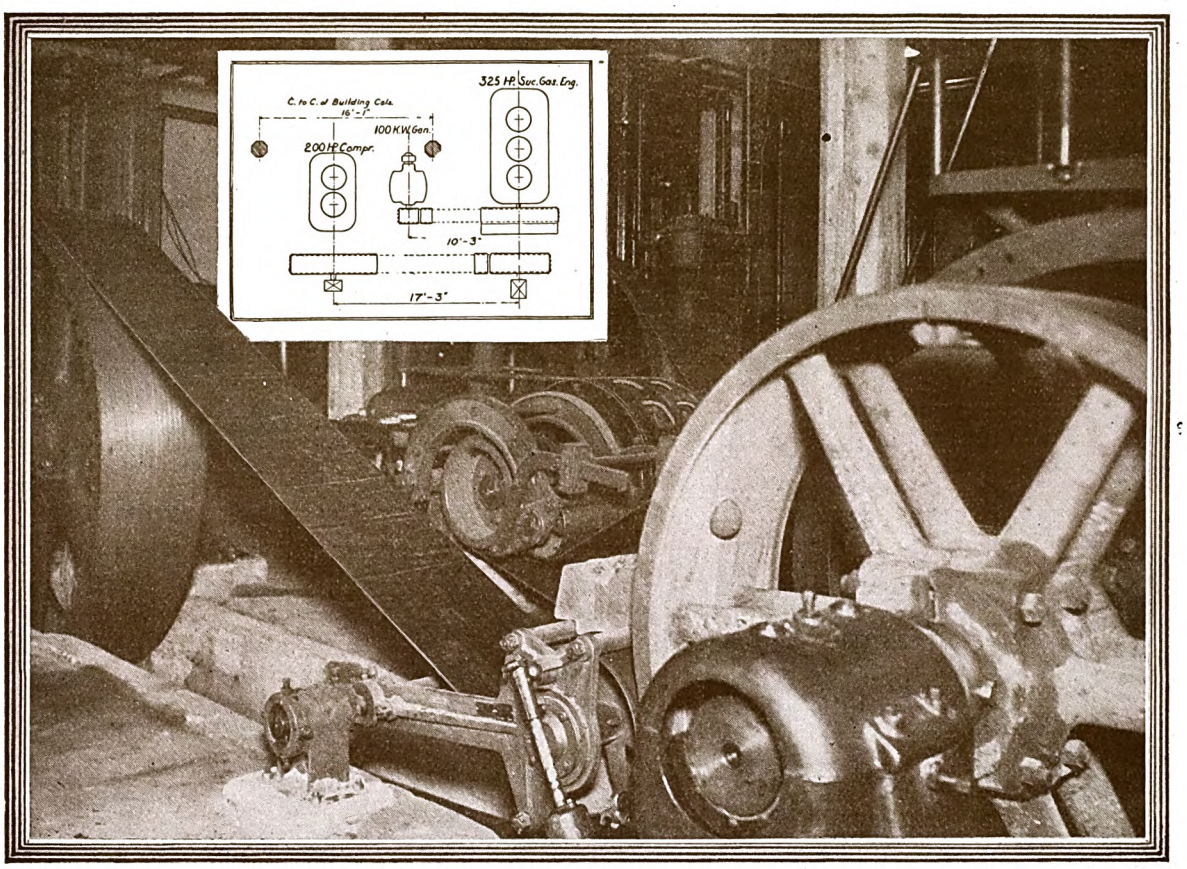
Send for Bulletin 6001.

PENNSYLVANIA CRUSHER COMPANY

1320-1325 Stephen Girard Bldg.

PHILADELPHIA, PA.

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Another Example of the Advantages of The LENIX DRIVE

The LENIX Drive has solved the problem of this company of co-ordinating a compressor and a 100 KW generator with a 325 HP suction gas engine. The centers are 17′ and 10′ respectively. Thirty feet centers would be required with ordinary open belt drives. Three of such combination units, as illustrated, are installed and operating.

In addition, in the same plant, there is one LENIX on a 400 HP suction gas engine driven compressor and one LENIX on a 60 HP motor driven compressor.

The special design of these LENIXES automatically adjusts itself to all the irregularities in starting the suction gas engines.

The varying power requirements of the compressor and generator may cause one belt to stretch more than the other. The LENIX compensates for the uneven stretch of the belts by automatically taking up the slack and utilizing it to increase the arc of contact between the belt and pulleys, thereby bringing into working contact the hitherto unused surfaces of the belt and pulleys.

Wherever belts are used in power transmission, the LENIX will improve your drive

Booklet "Saving Slippage and Space" describes the LENIX. A copy will be sent on request.

Five Points

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains, constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

F. L. SMIDTH & COMPANY
ENGINEERS
50 Church Street, New York, N. Y.

The LENIX DRIVE

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CELITE PRODUCTS

Barriers to Industrial Waste



SIL-O-CEL (PREVENTS HEAT PENETRATION)

TRADE MARK REGISTERED U.S. PATENT OFFICE

(*A Celite Product*)

SIL-O-CEL—INSULATING BRICK—prevents heat loss through furnace walls and on all types of high temperature equipment. An effective and economical insulation with an exceptionally low heat conductivity. Easily applied, low in cost; a permanent insulation.



SIL-O-CEL—INSULATING POWDER—less than one-tenth as conductive of heat as an equal thickness of fire brick or red brick. Used between fire brick and steel shells or red brick walls; is sufficiently elastic to absorb expansion and contraction strains; does not settle out or shrink.



CLECOTE—a plastic, bitumastic compound especially prepared for application to the brick surfaces of heated equipment to prevent air infiltration, and also as a waterproofing. It adheres firmly to the brick and mortar, remaining permanently elastic; expanding or contracting with the surface to which it is applied. Celcote will not dry out, become brittle or lose its effectiveness with age.



FRAXITE (High Temperature Cement)—a bonding cement scientifically compounded for setting and facing fire brick work on all types of furnace construction. Furnished in three grades of various temperature ranges. Fraxite prevents fire brick from cracking or spalling, and greatly lengthens the life of the entire refractory structure.

CELITE PRODUCTS COMPANY

ADDRESSES
New York, 11 Broadway
Chicago, 53 W. Jackson Blvd.
San Francisco, Monadnock Bldg.
Montreal, Can., Celite Products, Limited

Gentlemen: Send Bulletin X-6C and explain in detail the advantages of SIL-O-CEL Insulation, how it saves fuel, increases capacity and maintains even temperatures. I am particularly interested in the insulation

of .....
Name type of equipment



Name.....

Firm Name .....

Address.....

(*Continued from page 46*)

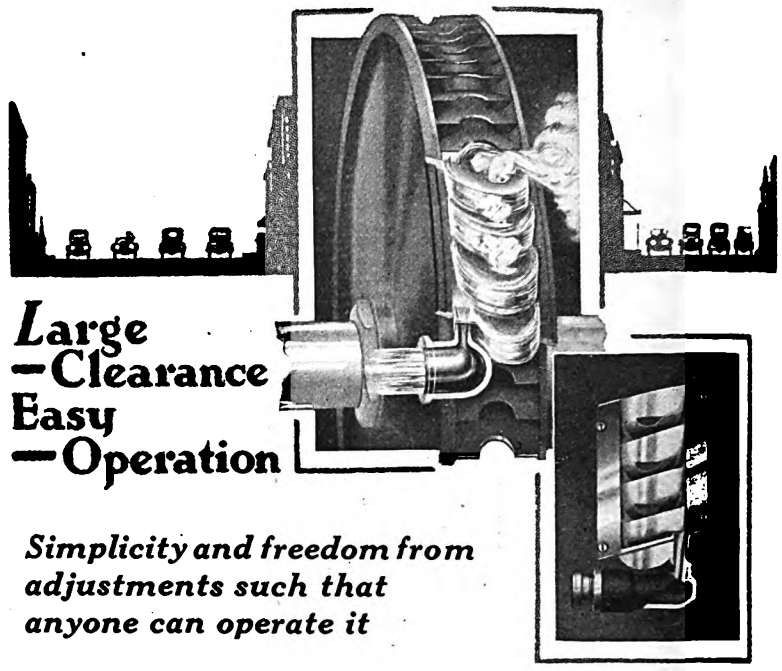
pressed with two outstanding facts: the very large amount of capital tied up in power producing machinery and the great number of inefficiencies still existent. The author of that statement had in mind the privately owned or so-called isolated power plant, and his impressions were undoubtedly justified. As one goes through the central station power plant and over its distribution system, two facts stand out: first (as in the case of the industrial power plant) the huge amount of capital invested in land and machinery and, second, many efficiencies made possible by large scale power production or growing out of the necessity for maximum economy which exists in every commercial enterprise.

The strength and scope of the expansion of business activity in this country have been accentuated by develop ments since the beginning of the year. The usual seasonal slackening in many lines has not appeared at all or has been less pronounced than would ordinarily be expected.

New records for the season in car loadings, the increasing congestion and rising prices in the iron and steel industries, unprecedented activity in the cotton manufacturing industry, intense and increasing activity in other industries—all attest a rate of production and distribution of commodities which surpass most expectations.

Average wholesale prices since the beginning of the year have been fairly constant, with only a slight upward movement, the index numbers showing the same tendency toward stabilization in January that appeared in December. In the case of certain commodities, notably some basic products, considerable increases have been recorded, offset by declines in other prices. It is apparent that, unless the rise in prices of raw materials is checked, further advances in prices of consumption goods may be expected. Resistance to rising costs of living, however, is a factor that cannot be ignored in estimating the probable further increase in prices.

—*The Guaranty Survey.*



Large —Clearance Easy —Operation

Simplicity and freedom from adjustments such that anyone can operate it

THE steam turbine in the smaller sizes suitable for industrial use is very different in its construction from the large complicated units commonly employed by the big central stations. The central station has carefully trained and competent engineers who are nearly as familiar with the design and construction of these intricate steam turbines as their manufacturers. In the industrial plant there is a different state of affairs. The operators have a greater variety of duties and can give less attention to each individual unit. For this reason simplicity and freedom from delicate adjustments has been the keynote of Terry turbine design, as can be seen from its fundamental principle of operation. Instead of a great many wheels, with literally thousands of blades running with very fine clearance, there is but one solid wheel without blades but with pockets or buckets milled in the edge. This construction does not require fine clearance for efficient operation. A gap of one-eighth of an inch exists between the bucket edges and the stationary reversing element. The side clearance is greater than one inch so that careful adjustment of the end thrust is not necessary to maintain safety. If for any reason the bucket clearance should become reduced, the smooth protecting rims at the sides of the wheel would rub on the smooth part of the reversing element, stopping the turbine before damage could result. Write for Bulletin Z-25 which gives a complete description and shows many of the practical industrial applications. Be up-to-date, use turbines, and for simplicity and freedom from worry,

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What *Is* Money?

By John S. Watts

WHILE we all use money every day, there are few who have any but the most sketchy ideas of why the notes or coins used as money are accepted by themselves and others in return for their labor, or in payment for goods. The fact of the matter is that practically everyone accepts money in return for value given, simply on faith that this money will be accepted in turn when presented by them to some other person from whom they desire to purchase goods or services. This faith is based solely on past experience that such money will be accepted as having real value, and not, as it ought to be, on a reasoned knowledge of what it represents, or from whence it derives its value. The disadvantages of this ignorance about money are many, the principal ones being that prosperity can be held back by the banks and other financial bodies withholding money from circulation, and that governments can add to the money in circulation without impairing the value of that amount already issued. If our people can be educated to understand where and how money is given its value, they would cease to blame adverse conditions on some mysterious entity which they ignorantly conceive to be lowering the value of their money, and address themselves to correct the real trouble.

For some centuries now, the metal gold has been used almost universally for monetary purposes, and it is probable that it will remain so to be used, as it does not seem possible to find anything that will answer the purpose better, although it must be admitted that it is by no means a perfect standard of values. To gain an understanding of the money question, it is essential that we know just what money is and what it is intended to be and do. A piece of gold money then, be it a dollar, sovereign, franc or mark, is actually a certain fixed quantity of gold of a standard purity, and has therefore a minimum present value equal to the value of that amount of gold at the present market price. It also follows that the gold coinage of any country has a fixed relative value to the gold coins of any other country, and therefore if all countries used nothing but gold coins or their equivalent, exchange values could vary only very slightly.

The ideal monetary unit would be one whose value, expressed in other units would be as stable as are these other units. For example our measures of weights, lengths, capacities, etc., are all exact and determinable, and are mathematically inter-related one to the other; the gallon measure of capacity is fixed at so many cubic inches; a yard is always a yard in length, and a pound weight is the same now as it always was. So also are the engineering and electrical units of power and force fixed scientifically in easily comparable terms of the other units. The unit of value, the dollar, is the only unit that has no fixed value in terms of any other unit or material than gold; that is, a gold dollar cannot be declared truthfully to be equal to a bushel of wheat, or to anything else but a dollar's worth of gold; not so much that the gold varies in value, but because the wheat does vary in value according to its scarcity or otherwise, and according to the wages paid for the labor used in its production and transportation, as do all other commodities and services.

WE must consider now what we mean by the value of a certain amount or quantity of material. It would seem that a bushel of wheat being always a fixed quantity and weight of wheat, and a gold dollar always a fixed weight of gold, the two should be interchangeable on a fixed basis with only minor fluctuations due to temporary maladjustment between supply and demand for wheat; and if all money were actually gold, and the labor entering into its production paid a stable rate, this would be the case. When we speak of the value of anything, we mean the worth of the goods we can get for it, but as everyone does not want the same things at the same time, this value has to be quoted in terms of one thing, namely gold, to which the value of all other things is referred.

A GOLD coin, then, is intended to represent a standard value, and as near as may be a stable value, but it can be demonstrated that gold has acquired a fictitious value; that is, one higher than its real value through and because of its use as money. What I mean is that if gold were not used for money, none would give the same amount of wheat, say, for the amount of gold that is in a dollar that they do now, because the demand for gold would not enable them to exchange it again for anything equal to the value of the wheat.

To make this more clear, let us suppose that all the debt owing to the United States by the European countries is paid in gold. This would leave all those countries outside of the States, without that metal. As it happens that gold is not an essential metal (in the sense that the world could quite comfortably get along without it) it might conceivably occur that Europe after paying its debts might decide to dispense with gold, and refuse to accept it back from the States in payment for goods and services more essential than gold. This action would reduce the value of gold to its intrinsic worth as a metal, which (as its main use, apart from coinage, is in the manufacture of jewelry) would become still less, as an over supply of any material used purely for ornamentation, very rapidly depreciates it in the eyes of those who desirse to display their wealth by wearing rare metals. If gold were as essential as coal, iron or food, the case would be entirely different.

On the other hand gold is the metal best fitted for monetary use, being incorrodible, easily tested, and fairly well distributed over the world's surface in sufficient quantities for the purpose; and yet not occurring in such huge amounts as to cause any fear of its ever being depreciated by the discovery of any immense deposit. So as long as the world continues to use a purely gold coinage, its value would be expected to remain fairly constant. And until paper money began to be used, the value of gold coinage was quite stable. When a country is said to be on a gold basis, we mean that all the money issued in that country is either in gold coins (omitting for clearness the consideration of silver and copper coins) or in paper, against which there is held an amount of gold equal to the face value of the paper. This paper money being redeemable in gold on demand and in full, these certificates are in every way equivalent to gold coins. The original idea in issuing notes was to save the loss due to the wear on the gold by continual handling.

WITH gold money exclusively used, any money issued must represent a real increase in the wealth of that country in this way:— a gold mine, having produced a dollar's worth of gold, sells it to the government and receives a dollar coin for it; the transaction practically amounting to simply converting the gold into coinage, and returning it to its owner. The total wealth of the country has been increased by one dollar's worth of gold, and the money in circulation by an equal amount. But at the same time during which the gold was being produced various other forms of wealth have also been produced, some temporary, such as food and fuel, and others more or less permanent, such as buildings, roads, etc.

We see therefore that on a gold basis, our money will be absolutely sound, but we are confronted by the difficult problem of deciding how much money is needed. We would have to decide how much gold to purchase for coining, some

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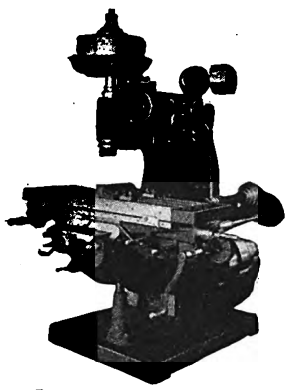
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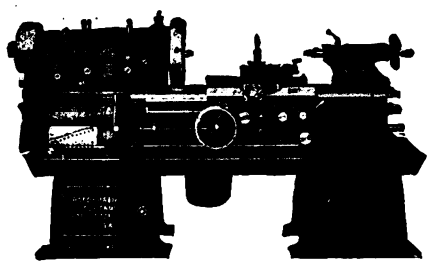
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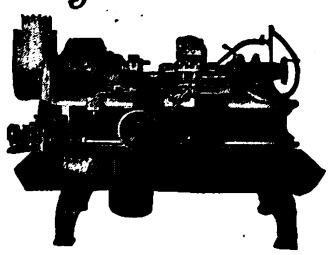
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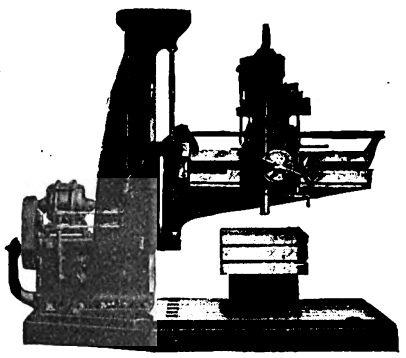
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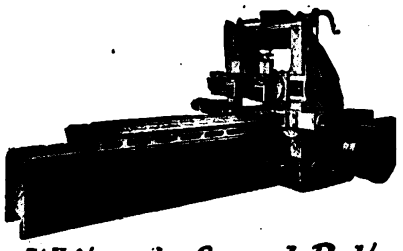
Reed Prentice Production Lathes



Reed Prentice Radial Drills



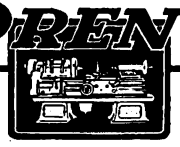
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time ahead of the need for the money. If too much is coined the wealth of the country is needlessly tied up in unproductive gold, and if too little, the business of the country would be seriously inconvenienced. This difficulty is overcome by issuing notes and purchasing gold to the value of the notes issued, reselling the gold as the notes are retired from circulation.

The amount of money in circulation in any country can be no criterion of the wealth being produced in that country, nor does the total money in a country represent the wealth of that country, or indeed any fixed proportion of it. The real measure of the wealth of a country is its income, or in other words the value of the goods it produces in a year, over and above the value of what it consumes in gaining this production.

The above should clear up the common fallacy embodied in the phrase that "the world cannot pay its debts because there is not money enough in existence to do so." Our debts are not, in the final analysis, paid in *money,* but in *goods,* and our ability to pay a debt is dependent upon our ability to produce; while the volume of our production is limited only by our intelligence and energy, and by the possession of the means of production—such as land, machinery, etc. If I have a thousand dollars and keep it locked away, I get no income from it. But if I spend the money to purchase machinery which can make some useful article, I will have an income from it and still have the equivalent of the money in the machine; so that if I have not the money, still I am richer, because I have an *income* which, being permanent, is real wealth. The possession of money, then, is not a measure of wealth (except it be potential wealth) but the possession of productive machinery is positive wealth.

Money is only needed to facilitate the trading between producers and consumers, and as money in itself produces no wealth, no one keeps more money on hand than is needed for immediate use; any more money than this that comes in is at once invested in the business of producing—that is, is spent on the means of producing—or left at the bank to be there loaned to others who can use it. It follows that the amount of money needed for circulation in any country is only that to be used for cash transactions, and for the accumulation of small amounts saved out of income until they reach a total sufficient for reinvestment in another productive unit.

The amount of money needed in any community may fluctuate considerably from time to time, and if there were no banks, the currency would be always either too plentiful or too scarce. The banks act as a reservoir, accepting money from those having more than their immediate needs call for, and paying it out to those needing it. Still, there is nothing to ensure that there will always be sufficient money to pay for all the goods that may be offered for sale on any particular day, except the accumulated experience of the bankers as to the demands they may expect. Owing to the fact that most transactions are settled by cheques, the money in circulation covers only a very small percentage of the actual trading being done, and if it were not for cheques, the money in circulation would have to be increased tremendously.

One other difficulty is that which we have when the Western Wheat is harvested and delivered by the farmers to the elevators. Here we encounter a demand for a large amount of money; in addition to that ordinarily needed, and which cannot be satisfied by cheques. Let us see what would result from having sufficient gold coinage to pay for this wheat crop. The farmer generally runs up bills for a year on the strength of his coming crop, and, when this is harvested, pays these bills from the proceeds, and deposits in the bank any surplus. His creditors likewise pay their bills, and deposit a part; and so on down the line, until in a few weeks the money is practically all back in the hands of the banks again.

For about three-quarters of the year, the banks would have more money than they could find work for, and only during the other quarter would all their funds be earning returns.

(*Continued on page 53*)

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A 200 horse power Fulton Diesel was installed in a central power station in 1917. Its power savings soon paid for a second Fulton Diesel, installed in 1919. Savings by these two then paid for a third, purchased in 1921.

The Fulton Diesel—American built, perfected internal-combustion, stationary engine—running on low-grade fuel oil, may be likened to a huge, high-class automobile motor in a power plant. Instant in action, automatic in control, consuming fuel only when in use and maintaining continuous high efficiency with practically no upkeep cost. In addition, it operates on one-third of the fuel required to produce equivalent steam power. A self-contained power unit, it calls for no investment in boilers, stacks, condensers or any such steam plant auxiliaries. One engineer runs it. Fuel handling and waste removal, with all attendant labor costs, are abolished.

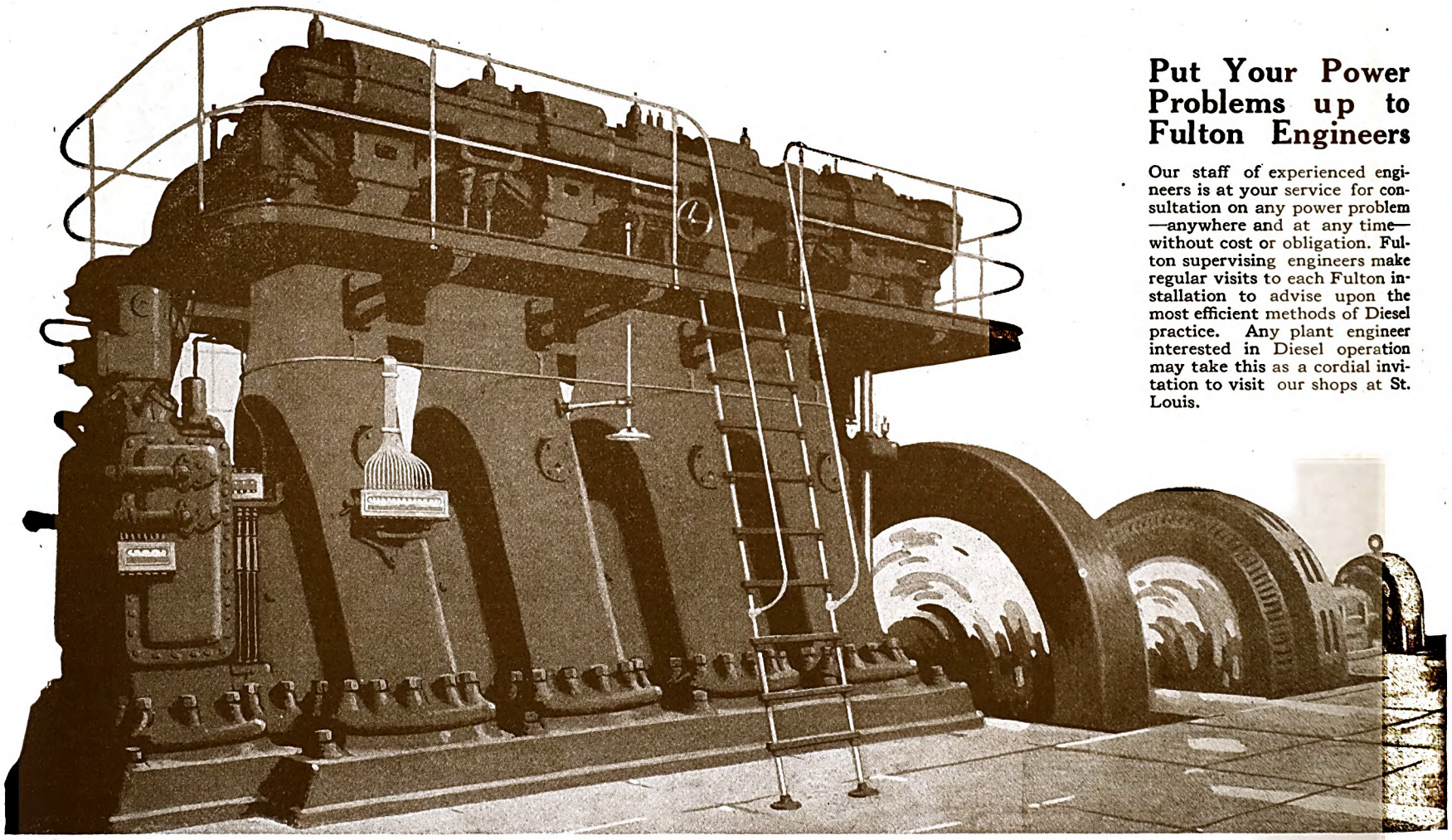
The Fulton Diesel is a development of 70 years' successful experience in engine building. Ten years have been concentrated on perfecting it, and its economy and efficiency stand proved in varying and exacting tests of service. Thus, through its mechanical excellence, the Fulton Diesel is established in the industrial world today as the stationary power producer that saves the appalling cost of power waste.

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(*Continued from page 50*)

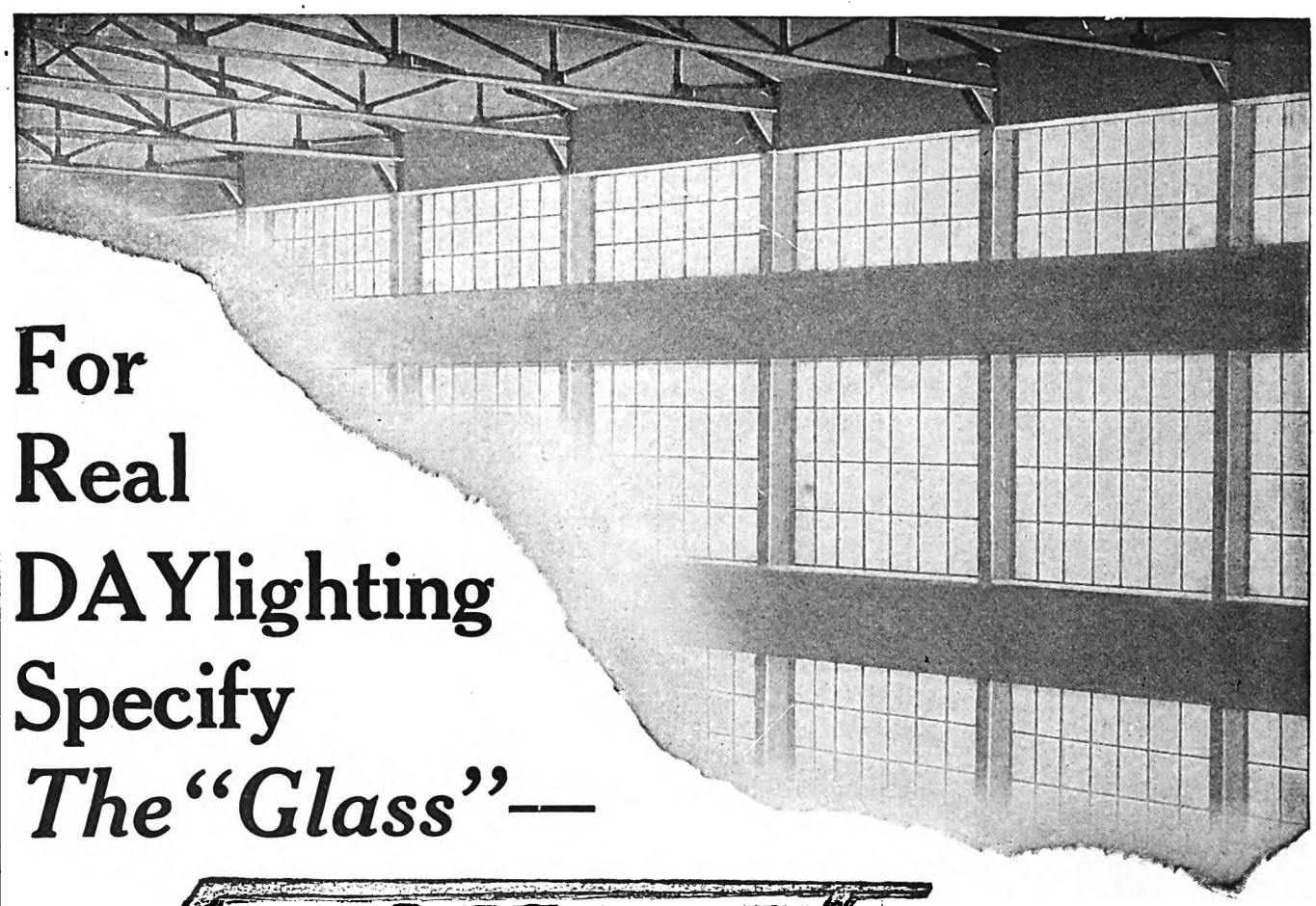
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If the unsecured money is *not* retired, the effect will be that the total currency will be depreciated, and will eventually reach a state of stability where the total currency will have a value equal to that of the gold which is available to meet it, plus an amount dependant upon the credit of the country of issue. The latter, in turn, is rated from a consideration of its productive powers. It follows that if a country continues to issue more and more paper without increasing its gold reserve, the paper will fall in value, the total value of the paper money issued remaining practically stationery.

The situation is analagous to what I would be in, if having a hundred dollars, I purchased two hundred dollars worth of goods, paying half



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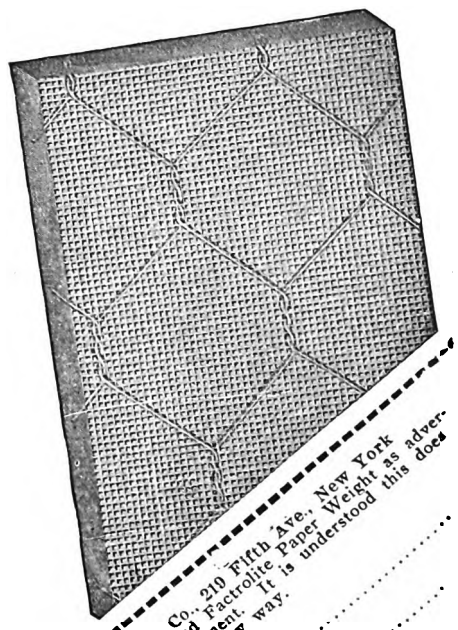
When direct sunshine strikes on windows glazed with "FACTROLITE," the workers do not have to work in a blinding glare or to hang blankets or shades to check the sunlight. FACTROLITE gives perfect diffusion that eases eye strain on the workers nearest the glass and gives those deep in the building interior a clear **diffused** daylight to work in.

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for some workers in a Boston publisher's bindery. Fatigue is decreased by the perfect adjustment possible with this chair to the individual seating condition.



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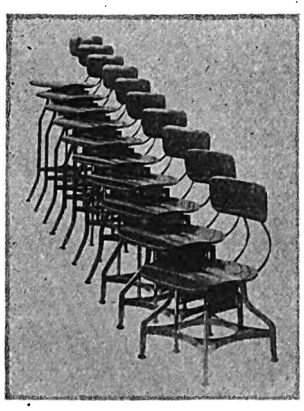
The PosturChair is designed to fit the seated body. It encourages good posture and makes it the comfortable position. It has been designed by experts in seating. It is approved by a nationally known health organization—the American Posture League, and each chair bears its label.

It is a piece of production machinery and as such is being adopted by large employers of labor everywhere.



This chair supports the body where support is needed and eliminates preventable fatigue.

Special Features: Made of cold rolled steel except seat and back support which are of wood. 10 heights, each with 3" height adjustment. Seat tilts forward or backward. Back support, swivel and adjustable in height. Durably constructed, neatly finished.



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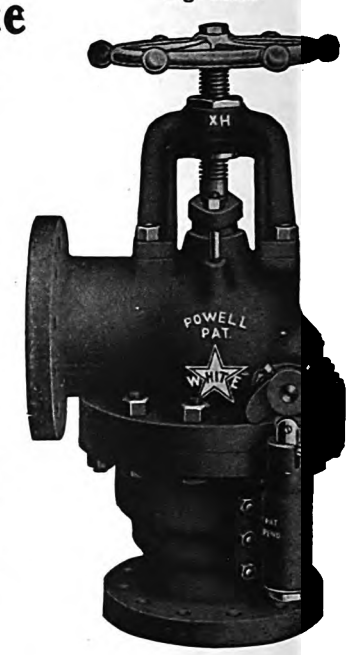
cash and half in notes. For this transaction if my credit is good, I would expect to get a full or nearly full two hundred dollars worth of goods. But if I purchased another two hundred dollars worth, paying again with my note, I would find that my custom was not so desirable, and would certainly find that the second two hundred dollars would not purchase as much as the first, and if I continued this process for long I would reach a stage where my note for two hundred would buy me no more than a loaf of bread. Evidently then, while it may be necessary at times to use our credits, it is safer and more desirable in every way to keep on a cash basis.

Consider now the common remark that there is a scarcity of money and that if it were more plentiful there would be more business done and work enough for all. Some of the radical labor element particularly contend that bad times are induced if not created by money being withdrawn from the market. The fallacy of this has been proved often, and is only mentioned here to make the article complete, and if possible to make the matter clearer. The "scarcity of money" story is started by a man or company who desire to start a business, or increase one, in which they see prospects of profit for themselves. To do this it is necessary to purchase equipment, and not having sufficient money of their own, they try to borrow some. Now the amount of money that is idle and looking for profitable employment does fluctuate considerably, and at a time when money is plentiful (that is, idle money) its owners are not so careful what they invest in as they are when little or no idle money is looking for employment, and this condition has given some similitude to the "scarcity of money" excuse. The essential fact is, however, that the world has produced and owns at any given moment, only so much productive machinery, and if this is all working no more can be had for any purpose, no matter how worthy it may be. Further, whatever machinery or goods may be then in course of manufacture will, in times of such scarcity, inevitably be sold to those bidders who, hav-

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Fig. 2228



Powell Triple Acting Valves automatically close when a tube bursts —isolating the boiler.

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Rectigraph emulsions are coated upon a high grade 100% rag stock, producing excellent results with a durable base. Rectigraph paper is a contrasty bromide paper with excellent orthocromatic qualities, and will reproduce colors perfectly. All the speed consistent with good quality.

The RECTIGRAPH COMPANY has always regarded acceptance of an order as a pledge that it would be filled at the earliest possible date. The output of our plant belongs to our customers with orders on our books. This policy compelled us, during the past few years, to decline much desirable business which would have been highly appreciated, but this could not be considered without prejudice to previous connections. Improved facilities in our new plant enable us to increase production and quality and to decrease manufacturing costs. *Our Customers will benefit.*

It may be to your interest to become acquainted with Rectigraph paper. We would be glad to receive your order for a sample roll, spooled to fit your photographic apparatus. You can then judge of its merits.

Rectigraph Company

(An Independent Corporation)

ROCHESTER, N. Y.

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ing the best propositions, are best able to pay for them; or, what is the same thing, those whose credit is best.

We come now to the final phase, the fluctuating value of money measured in the amount of goods which it will purchase. The value of any material is the value that is given to it by the labor spent upon it in finding the raw material, manufacturing, transporting and selling it. Even gold itself, our unit of value, is of no value until it has been discovered, and only reaches its full value after it has been mined, smelted and delivered to its market. The relative value of all materials or goods, is in reality the relative value of the labor used in its production, including of course the labor used in the manufacture of the machinery necessary for producing this material.

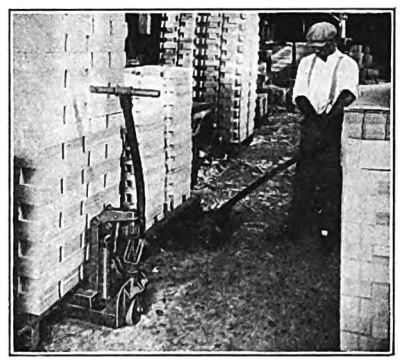
Over a limited period of years during which no serious disturbance has occurred, an hour's labor, of a certain class, can be shown to have had a fixed value measured in goods such as food and clothing. To have common labor it is essential that such labor be paid enough to live on and propagate, otherwise we should soon have none. And to encourage the learning of a trade, the higher skilled worker must be paid enough more to make the acquisition of this skill desirable. Whether the unskilled laborer produces as much value as he receives, is another question which does not affect the present subject.

Coming right down to the basic, elemental factor, if we could use an hour's labor as our unit of value, we would have a really stable unit; the cost and hence the value of all materials, as we have seen, being really the cost of the labor spent upon it. Of course the standard of living has been raised, in comparison to what it was, and probably will continue to be, but this increase in the goods paid to labor, has been attained by the use of machinery which has increased the income of the world. Labor, by the use of machinery and under skilled direction, has been enabled to produce *more* value per hour per man, and has shared in this increased production.

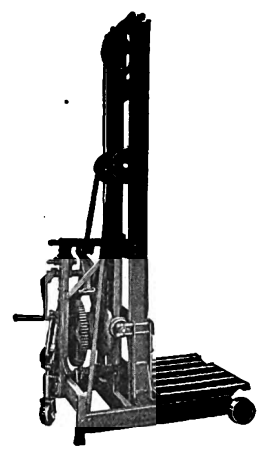
As all wealth is produced by some form of labor, skilled and unskilled, manual or mental, it follows that in exchanging what we have produced for what we need, we are really trading in labor, and if we paid (that is, valued) a week's labor at $15.00 ten years ago, and increase this to $30.00 now, we would expect to find that $30.00 will purchase to-day no more than did $15.00 ten years ago—namely, the amount of goods equivalent to a week's support of a laborer at the then ruling standard of living.

This is evidently true in a general way, after allowing for the effect of other factors, such as an increase in the standard of living, permitted by increased production per man, inflation of the currency, and the increase in the percentage of a man's production absorbed by taxation. The point I wish to make is that an hour's labor is the real measure of values, and that all other values are automatically regulated by that factor.

Turn the Overhead of Useless Work into Actual Profits!



The Lift in Less Space



Lewis-Shepard Stacker
The Perfect Portable Elevator

Appalling Labor Wastage,—Due to Old Fashioned Handling and Rehandling of Goods and Materials

Live Facts show Labor Cost will continue increasingly to be the most expensive item of production in American Industry

In many concerns 20 to 50% of the Labor Cost is confined to so-called "Cheap Labor,"—engaged in handling and rehandling Goods and Materials—usually in cumbersome, antiquated fashion. These conditions form one of the main sources of the rapidly rising tide of Waste Labor,—a Waste not only appalling, but unnecessary,—BECAUSE

Adoption of Proper Handling Equipment Turns Large Part of Present Labor Overhead into Actual Profits!

Twenty-four concerns increased profits over $59,000 in first year. In fact, *correct handling* equipment does far more than cut down the unskilled workers who now push, tug, shove and lift at heavy, bulky or fragile materials. The best modern handling equipment also increases storage space—floor and operating space—reduces breakage and spoilage; speeds production; and makes inventory and other business routine much more simple and accurate.

Lewis-Shepard Handling Equipment Saves Man Power and Money

by the simple but effective method of giving labor the most efficient tools to work with,—thus eliminating useless effort and slack schedules.

If you would cut down the overhead of useless work—if you would turn this overhead into actual profits—investigate *at once*.

LEWIS-SHEPARD HANDLING EQUIPMENT

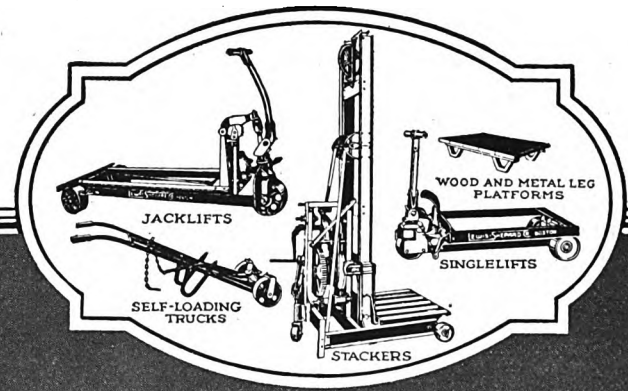
We Guarantee Results from Our Equipment Before You Pay

Not expensive. Over 4000 customers in past eight years. 50% New Business from Old Customers proves that NEW Opportunities for *Saving* follow the installation of Lewis-Shepard Handling Equipment.

Send for Our Free Illustrated Booklet

"24 Users Increase Profits $59,565.88 Yearly"

Write us today
at our Factory Address
Lewis-Shepard Co.
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Boston, Mass.



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Lewis-Shepard BOSTON

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THE SIXTH SENSE OF INDUSTRY

Tycos Temperature Control



If a sense of "feeling" ruled the Rubber Industry!

Suppose that raw rubber, taken from the initial softening vats was judged for pliability entirely by its "feeling" instead of workmen's knowledge that the time of soaking and the water temperature was correct! Suppose that after passing through washing mills and rollers it was taken from the drying rooms when the men "judged" it was dry enough —instead of the time and temperature being exactly regulated! Suppose the results of the great kneading mills was guessed by feeling, instead of further exact heat control. Or that vulcanization —that all important process—had accurate heat control let out and the elasticity or hardness of the vulcanized product had to be judged by sense of touch alone!

Truly, our rubber belting, automobile tires, rubber heels, moulded goods, combs, fountain pens, buttons, insulation, baloons, matting, storage batteries, and some thirty thousand other rubber products would be undependable and their life and usefulness an unknown quantity!

But sense of touch alone does not rule in the "bakeshop" that is really the modern rubber factory. Into the rubber industry enters that vitally necessary "sixth sense"—Temperature Control—supplied by the accuracy of *Tycos* Temperature Indicating and Recording Instruments. In great rubber factories everywhere *Tycos* Temperature Instruments are accepted as the standard of accuracy.

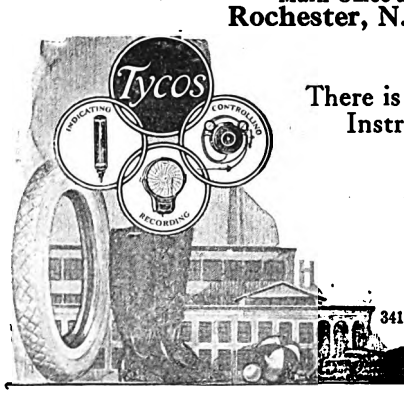
Manufacturers

What do you make? What is your problem of applying the "sixth sense" to your processes? For every purpose of heat control—in any industry—there is a type and style of instrument in the *Tycos* line, embracing as it does over eight thousand varieties.

Write us, and literature on any instrument or type of instrument will be sent you promptly. And our experts will advise you in its application in your plant.

Taylor Instrument Companies

Main Office and Factory
Rochester, N. Y., U. S. A.



There is a *Tycos* or *Taylor* Temperature Instrument for every purpose.

Canadian Plant
TYCOS Building,
Toronto, Canada

Tycos Temperature Instruments
INDICATING · RECORDING · CONTROLLING

Power Generation at River Rouge

(*Continued from page 23*)

stack, is hung upon the structural steel of the building, the total weight per unit thus supported being close to two and a quarter million pounds.

These boilers are under what one might term automatic control. Situated near each boiler is a three-panel control board, the center panel of which contains gages and recording instruments; the outer panels containing push-button control led rheostats for altering the speed of coal feeder motors, for closing or opening draft dampers, etc. By means of the instruments on this panel and of CO_2 recorders and feed water meters situated nearby, the one "fireman" or boiler operator assigned to each boiler knows exactly what is going on in all parts of the boiler at all times. By means of the push-button controls with their "start," "stop," "slow and fast" positions, he is able to adjust conditions to suit the load, merely by pushing a button or two.

Nine-tenths of the air necessary for combustion is introduced into the combustion chambers through hinged inlet doors which are opened according to required draft conditions. There is no escape of heat from these furnaces to the boiler house; in fact, steam radiators are provided to keep this boiler house warm in winter in spite of unusually tight and well insulated building construction. This in addition to the average stack temperature of 550 degrees speaks well for the absence of such heat losses.

Enough water is evaporated by these boilers daily to flood an area of two and one-half acres to a depth over two feet.

Approximately nineteen per cent of this total evaporation is not recovered through condensation, being lost in its use for process heating in various parts of the plant. To make up this deficit, distilled water is provided at the rate of 1380 tons a day. This is known as the "make up."

The department in which this huge quantity of water is distilled daily is known as the "evaporator room," and is situated directly over the blower room. The chief feature in this department is the double battery of evaporators or stills, nine in a battery, arranged in upper and lower groups, forming what is called "a double effect" evaporating system, the vapor distilled in the first effect group being used to heat the evaporating coils of the second effect group. In these stills the raw water deposits its impurities before going to the hot well. Before entering the double effect, however, its mechanical solids have been largely eliminated and the temperature of the Rouge water considerably boosted by having passed through a series of preliminary screenings and heatings.

From the hot well, water as required is drawn by means of three feed water pumps through open heaters on the suction line. It is then delivered to the boilers through low and high heat-level condensers which raise its temperature to approximately 256 degrees. The admission of the feed water to the boilers is controlled by feed water regulators and the rate of admission as well as the temperature and pressure are metered by recording meters.

The generator house is divided into two floors as stated before, the upper floor containing the two 12,500 kw. turbo generator units, which at present comprise the main alternating current equipment. These operate at 1800 r. p. m. under 200 pounds steam pressure and generate current at a potential of 4600 volts. Exhaust from these turbines is condensed by two large surface condensers, one for each unit, each containing 22,000 square feet of condensing surface. The vacuum normally carried is 28½ inches.

Eight complete turbine driven alternator units are now being built by the Ford Motor Company in their River Rouge shops from their own designs. Each alternator is to have a capacity of 30,000 kw. at 2300 volts. The entire project when completed will come close to aggregating a quarter million of horsepower under one roof. The condensing equipment is also being built by the Ford Motor Company.

The electrical load is con-

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trolled and distributed from the control room which is located in the "switch house," and which has a glass fronted bay overlooking the generator room. The operator by means of a push button equipped semi-circular control panel is able to literally "keep his fingers" upon the complete distribution of 4600 volt current generated at this plant. Like the modern central station installation there are no switches in the control room. These are located in the switch room below, inclosed in insulating cabinets, the switches being operated by motors whose operation is actuated by the push buttons on the control board. The air entering this room is refrigerated and dehumidified, thus reducing to a minimum the danger of arcing.

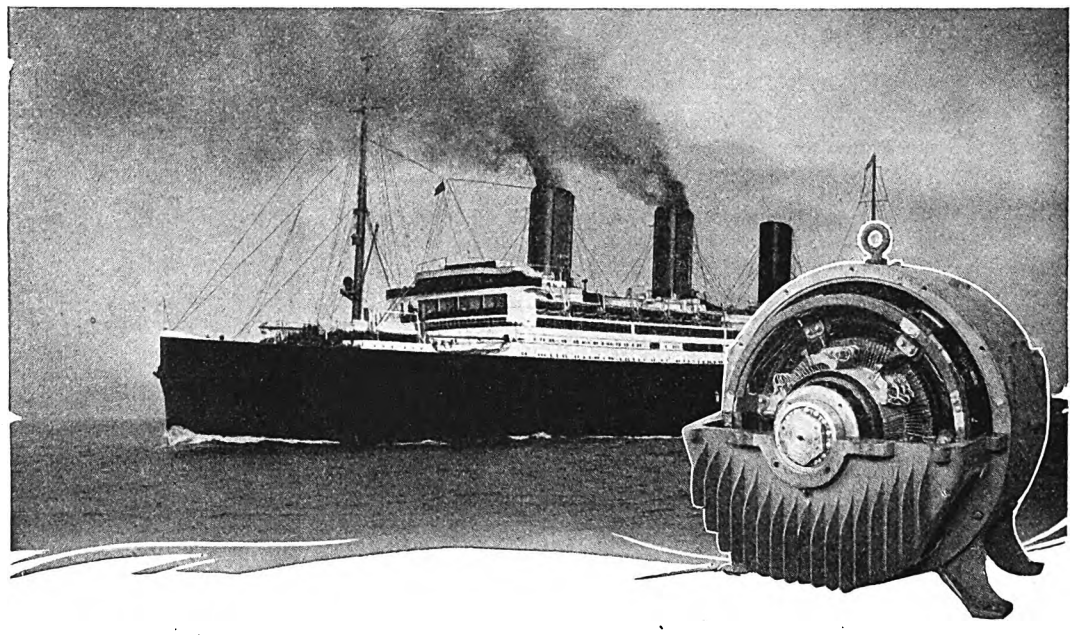
Taken altogether, the River Rouge power plant probably represents the ultimate in present-day development of power generating equipment. In it, waste utilization is carried to a high degree, heat losses are minimized, automatic control developed to a maximum and mechanical recording of all functions carried out. One seeing this plant might observe, "What is there left for the engineer to do?" There is a great deal left to do, in fact more to be done in the future than has already been done in the past. Lest one should get the idea that we are reaching anywhere near the ultimate in power production, we are quoting some extracts from an article by Mr. H. A. Spoehr, of the Carnegie Institution of Washington, which appeared in the January issue of the British publication, *Beama.*

"The fundamentally important point is in relation to the energy changes. The energy expended by the man has been permanently lost to a large extent; similarly, that obtained from fuel. The reconversion of the carbon dioxide into food or fuel material can be accomplished only by the use of a great deal of energy. The cycle is made possible only by the introduction of energy from without. This energy is derived from the sunlight, which the plant, unlike the animal, is able to utilize and convert the waste carbon dioxide again into food or fuel material.

"It thus becomes evident that all life on the planet depends upon the energy derived from the sun through the intermediary of the plant —*i.e.,* through the process of photosynthesis. Mankind lives entirely on the energy derived from the sun through the pursuits of agriculture.

"But in addition to this, we are squandering the principal of an enormous legacy of solar energy accumulated during the past ages. The fossil vegetation, preserved as coal and oil, represents a very small fraction of the energy which has been falling on the earth and which has been conserved for man. It is kindled, its energy liberated and used in a thousand ways, and the rays of sunlight stored beneath the earth for millions of years

SKF



Leviathan Relies on Ball-Bearing Motors for Continuous Forced Boiler Draft

THE giant ocean liner Leviathan, now being reconditioned, depends upon two 60,000 cu. ft. blowers to supply the forced boiler draft necessary to obtain its high speed of propulsion.

The direct-connected blower motors, therefore, must operate continuously for days in the hot hold of the ship and at times amidst the splashing of water.

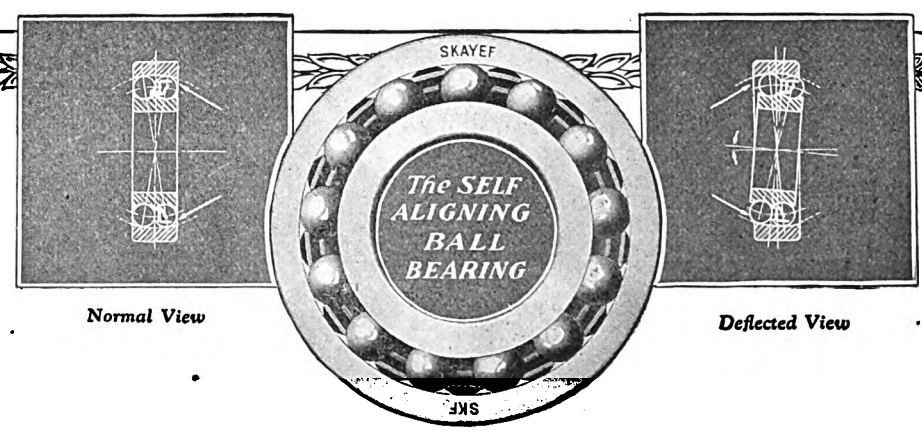
Two direct-current Diehl motors with special heat-radiating, water-tight enclosing covers are used for this purpose. The continuous duty rating of these enclosed motors is 50 H.P., 110 volts, 360 to 475 R.P.M.; the normal open rating being 150 H.P. Protection against motor failure due to dropped armatures and oil-soaked commutators and windings, is obtained by supporting the shafts on SKF marked self-aligning ball bearings mounted in sealed housings.

Their use for this exacting service and on the 29 Diehl motors used for general ventilation, is typical of the wide adaptability of ball bearings.

THE SKAYEF BALL BEARING COMPANY

Supervised by SKF INDUSTRIES, INC., 165 Broadway, New York City

875



BALL BEARINGS
The Highest Expression of the Bearing Principle

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GOLDEN-ANDERSON

"Life and Property Insurance Valves"

Patent Automatic Double-Cushioned Triple-Acting and Non-Return Valves

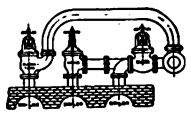
PROTECT YOUR PLANT AND GUARD YOUR MEN



DOUBLE EXTRA HEAVY VALVES

"Every Valve Sold with a Positive Guarantee."

"Hosts of References."



4100

Golden-Anderson Life and Property Insurance Valves are used in the iron and steel industry. Their repeat orders are the result of assured protection.

These Golden-Anderson Double Extra Heavy Patent Valves give absolute protection in case of back flow, pipe explosions, or admission of steam to cold boilers.

1—Instant isolation of a boiler in the event of a bursted tube or any other internal break causing a sudden drop of pressure.
2—All steam flow cut off the moment a steam line breaks at any point in your plant.
3—Boilers automatically cut in and out of service to equalize the pressure. This eliminates cutting in a fresh boiler by hand.
4—Cannot be opened by hand unless provided with patented safety latch attachment. It prevents the possibility of admitting live steam to a cold boiler.
5—No pounding, chattering or sticking. The perfectly cushioned double Corliss Dash Pot insures positively quiet seating.
6—The only valves that can be tested from the boiler room floor.

Golden - Anderson

Automatic Cushioned Water Pressure Regulating Valves



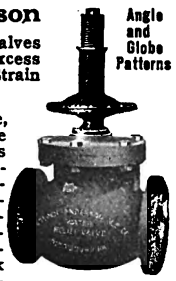
Will establish positively, steady reduced water pressure.

Easily adjusted from the outside. Fitted with patented safety piston to remove danger of high pressure from reaching low pressure side. Cushioned by water and air. No shock in seating.

Sizes to 30-inch.

Golden - Anderson

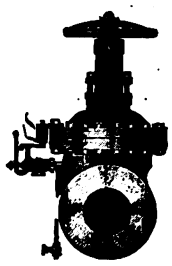
Cushioned Water Relief Valves Automatically Relieve Excess Pressure—Prevent Stress, Strain and Bursting Mains.



Angle and Globe Patterns

Essentials of a durable, economical and reliable relief valve are first class material and workmanship, correct mechanical construction and operation, with no metal-to-metal seats, and perfect air and water cushioning to avoid shock or hammer on the various pressures, all of Golden-Anderson Patent Automatic Cushioned Water Relief Valve.

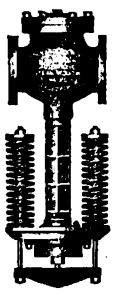
Sizes to 30 in.



GOLDEN-ANDERSON PAT. CUSHIONED COMBINED THROTTLE AND AUTOMATIC ENGINE STOP VALVES

Gives perfect automatic control of steam or air flow in any pipe line from one or more distant points.

Can be opened or closed instantly in emergency by steam or electricity. May be tested while in service giving complete assurance of safety.
Sizes to 30"



GOLDEN-ANDERSON PAT. AUTOMATIC CUSHIONED STEAM PRESSURE REDUCING VALVES

Automatically holds the reduced steam pressure constant.

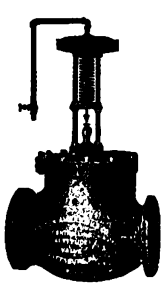
Fitted with patent safety piston that prevents high pressure escaping to low pressure side.

Sizes to 30"



GOLDEN-ANDERSON PATENT AUTOMATIC DOUBLE CUSHION CHECK VALVE

Especially adapted for Hydraulic Elevator Service and on discharge side of pumps.
Sizes to 30"



GOLDEN-ANDERSON PATENT AUTOMATIC CONTROLLING ALTITUDE VALVES

Automatically maintains uniform water level in tank, standpipe or reservoir. No floats or fixtures.

No freezing.



Golden-Anderson Valve Specialty Co.

1306 Fulton Building **Pittsburgh, Pa.**

give birth to a civilization such as the world has never known. It is this source of energy which has made possible the habitation of the temperat zones to the present extent, and on it depend our various modes of rapid transportation and our multifarious industrial activity. What may be called fossil solar energy, coal, made possible the reversal of the natural course by the smelting of ores for the production of metals. In fact, it is solar energy which counteracts the tendency of our earth to attain its maximum entropy.

"But this great civilization of coal and steel is at the same time a most squandrous and profligate one; it is using the principal of its legacy in numberless new ways. Modern man's greatness depends upon his being essentially a tool-using animal. To increase the efficiency of one-man power has been his object for centuries. It is the power-driven machine that has done most of his work. But the source of energy which drives these machines is not a steady stream, it is being drawn from the accumulation of centuries. A year's consumption of coal at the present rate represents the accumulation of hundreds of years. The power of man to do work, physical work, the unit one-man power, is now an almost insignificant factor. A return to such a physical standard would almost certainly follow the failure of such sources of energy as man now has at his disposal. The best of these sources of energy, coal and oil, is at present being pushed with a feverish intensity that has never been known before, and the competition for the possession of these stores recognizes no principle. The destiny of civilization is guided by and reflects the amount of available energy.

"And thus the scientific world is awakening to the necessity of taking stock of our available resources of energy. Repeatedly, attention has been called to the inexhaustible floods of solar energy. With cool theoretical nonchalance the untold possibilities of the use of the sun's energy are constantly called to our attention. Yet, the chlorophyllous

(*Continued on page 61*)

His Hand on his Machine's Pulse

The record of a Veeder Counter guides the machine operator much the same as a graphic chart guides the manager:

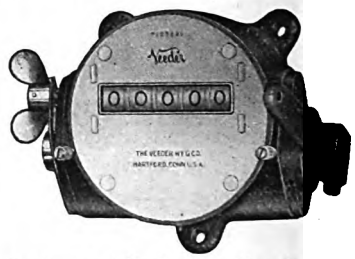
It tells how the work progresses; how production checks up with the standard rate; how fast the pieceworker is earning money.

It puts a man in position to intelligently *manage* his machine.

And with intelligent management goes a workmanlike interest that *scores high* on your

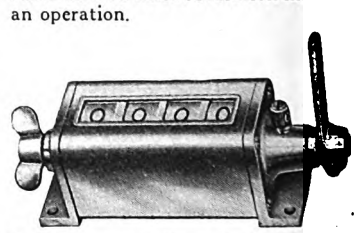
Veeder COUNTER

Here's a big new development in a Punch Press Counter; a heavy-cased ratchet mechanism, immensely durable:



Built especially for recording the product of punch presses, metal stamping machines and other heavy-duty machinery. Strong stops limit the movement of the lever to 45 degrees or ⅛ turn, which registers one on the dial. The large, legible figures are easily read ten feet away. Counter is regularly furnished with five figure-wheels, and may be *set back to zero* by one turn of knob. Requires no special fixtures for attaching. Price, $18.00.

The Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figure-wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set Back Rotary Ratchet Counter, to record reciprocating movements as on punch presses, $11.50 (list).

FREE—This new 80-page booklet shows everything you could ask in a counter. Ask for IT.



The Veeder Mfg. Co.

63 Sargeant St., Hartford, Conn.

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The Story of Roofs that Endure



in the New
"Cementile" Catalogue

Write for a Copy
USE
the
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Manufacturing Company
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New York Philadelphia
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TEAR OFF THIS COUPON, FILL IN, AND MAIL IT—NOW

American Cement Tile Mfg. Co., 831 Oliver Bldg.,
Pittsburgh, Pa. Please send me a copy of the
new "Cementile" Catalog

Name _____ TITLE _____
Company _____
City _____ State _____

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ELIMINATE REHANDLING



He runs the Cowan Hand Lift Truck under the loaded skid and with a single downward sweep of the handle elevates the truck platform, quickly and easily picking up the skid and its load. At destination, he steps on the foot pedal and skid and load are quickly and gently lowered to the floor.

No loading and unloading by hand—wasteful in time, labor and money. No truck delay. *One* man instead of a gang.

HOW many times are your goods and materials loaded and unloaded by hand in moving them from point to point? Each rehandling wastes time, labor, and money.

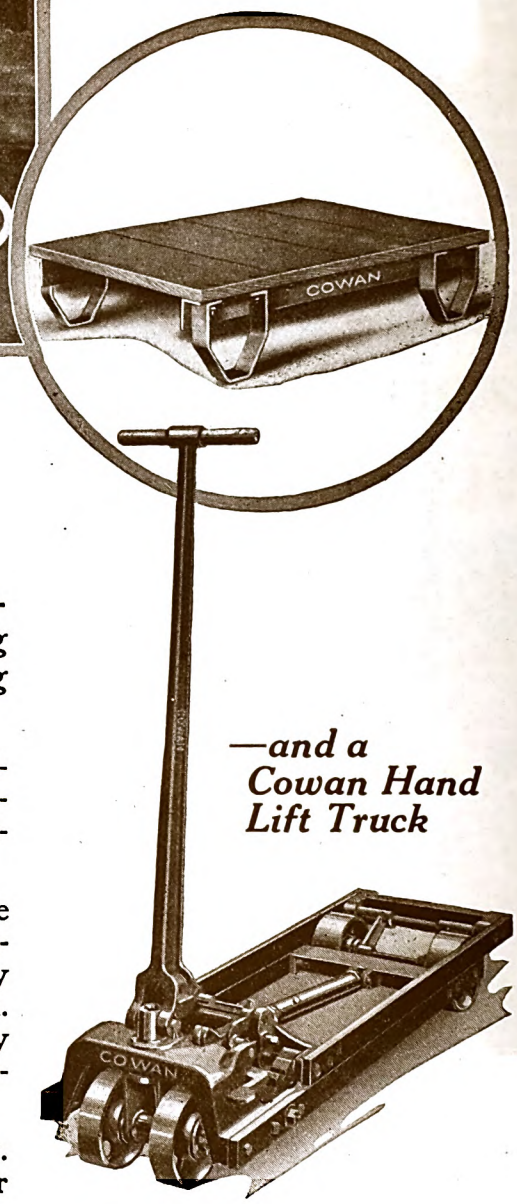
The Cowan Hand Lift Truck and Skid System has eliminated costly rehandling and greatly reduced truck equipment investment and maintenance for thousands in practically every line of business.

One man and a *single* Cowan Hand Lift Truck often serve as many as fifty to one hundred skid platforms—duplicating the work of an extensive equipment of ordinary trucks and the force of men necessary to handle them. Cowan Long-Life Skid Platforms are strong, sturdy, simply constructed, and inexpensive. Their maintenance is practically negligible.

Eliminate rehandling. Send for a Cowan System expert. Without obligating you in any way he will analyze your material handling problem and fully explain how the Cowan System can reduce your material handling costs. Or write, briefly describing the materials you handle, and we will gladly mail information pertinent to your particular business.

The Cowan System includes Cowan Hand Lift Trucks, Long Life Skids, Electric Lift Trucks, Electric Load Carrying Trucks, and Electric Tractors—used individually or in combination.

Cowan Skid Platforms for Your Loads



—and a Cowan Hand Lift Truck

COWAN TRUCK CO., 6 WATER ST., HOLYOKE, MASS.

New York Office: Grand Central Palace. Offices in Principal Cities

Largest manufacturers of complete Hand and Electric Industrial Truck Systems.

COWAN INDUSTRIAL TRUCKS-TRACTORS

Originators *of the* "through ticket" *system for* moving loads

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No. 644 Gauntlet Glove, reinforced with flexible steel ribbons clinched over strips of tough leather. Extra leather patch on the thumb. $16.00 perdozen pairs.

To Keep Production at its Height

STEEL-GRIP GLOVES



No. 605 Short Glove steel ribbon reinforcement and extra wearing patch in palm. $14.00 per dozen pairs.

No wonder your men can produce more when equipped with Steel-Grips,—they go at their work without any fear of torn or bruised hands, confident in the protection these tough gloves give them.

Just see how they're made—three thicknesses of wearing surfaces and a comfortable felt lining—flexible steel ribbon re-inforcement clinched over tough strips of leather. They can't come loose nor hurt the hand. All gloves are stitched with strong steel thread—no danger of seams ripping, burning nor tearing out.

Steel-Grips are built for long wear in rough service. They save the time the men ordinarily take up in frequent trips to the store room to get "another pair of gloves."

Different working conditions require different styles of gloves—we make gloves to fill all industrial requirements.

Send for catalogue.
Try a dozen pairs.

INDUSTRIAL GLOVES CORP.

2647 Maplewood Ave., Chicago.

STEEL GRIP
MADE IN CHICAGO

(*Continued from page 58*)

plant still remains the only converter of solar energy!"

The day is surely coming when we shall obtain our fuels from the earth's agricultural annual increase, and no longer be dependent upon stored reserves. The same thing will doubtless be true with regard to a great many of our common metals and building materials. So the wonderful Ford power plant with its smokless, cinderless, automatically controlled combustion, is but one of the early steps toward the ultimate in energy transformation. Our future engineers have ahead of them virgin fields of effort so wonderful that as yet we are incapable of even imagining them in our dreams.

The Society of Automotive Engineeers has recently been the recipient of many highly complimentary letters from the U. S. Government officials and prominent men in the automotive industry with regard to its Employment Service work.

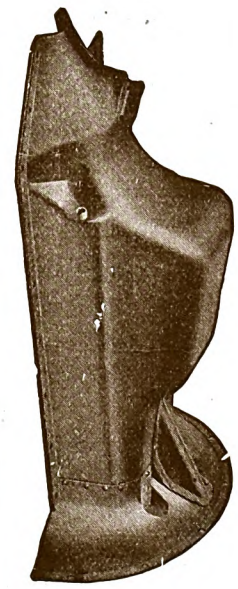
The appropriation for this work has been materially increased for the current year and, through a system of bulletins issued twice weekly, the Society keeps its members who are seeking employment, in constant touch with approximately one thousand of the leading manufacturers of passenger cars, cabs, trucks, trailers, tractors and farm machinery, isolated electric lighting plants, stationary engines, aircraft, motor boats, motorcycles, motor busses, motor railway equipment, production, machinery and tools, highway contractors and manufacturers of parts and accessories.

Since the establishment of the Bulletin service, the Society has placed an average of one man every other day in an engineering, sales or executive capacity, including general management.

The Service is free to any reputable company in the industry and may be used to a limited extent by applicants for positions who are not members of the Society, when the applicants have been endorsed by members.

Reduce Your Manufacturing Costs With Stampings And Pressed Metal Parts





IF you are now a user of pressed metal, it will pay you to get the benefit of our competition for your requirements. If you are using castings, forgings or wooden parts in large numbers, the chances are that our engineers can design pressed steel to take their place. Pressed steel is always lighter, universally stronger and generally cheaper.

And there's a reason.

We have a 15 acre plant which every day turns out 100,000 parts of every description—in steel, brass, aluminum, copper, monel and zinc—delivered to your plant all ready for assembly.

Presses of every size and description are available for the most intricate jobs irrespective of size or other dimensions.

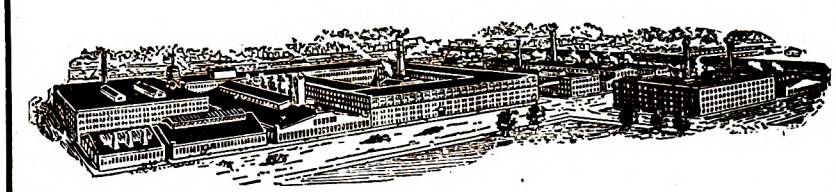
We are able to make and deliver metal parts to you at much lower cost than can be made in your own plant or in a small organization, because of our facilities, large scale output and careful attention to every detail of economical production.

Over 41 years experience in this work.

Let us show you what G. P. & F. Service can do in reducing your production costs. Send blueprints or samples for estimates. No obligation on your part, if you write

GEUDER PAESCHKE & FREY CO.
1457-1750 CANAL ST., MILWAUKEE, WIS.
CHICAGO: 352-358 WEST OHIO STREET

G.P.&F. Service
"Knowing How Since 81"

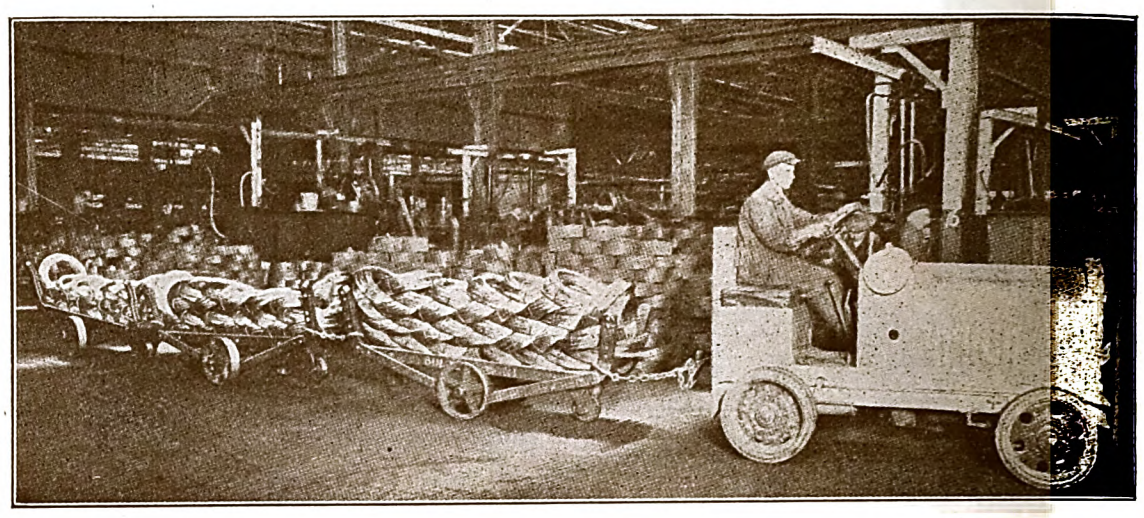


Over 15 Acres of Floor Space—

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THE TOWMOTOR

"Every Day
In Every Way"
Increasing Orders
Show that



TOWMOTORS

Are Justifying Their High Reputation for Quality, Economy and Service





THE TOWMOTOR COMPANY

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Cleveland, Ohio

THE TOWMOTOR

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Storing and Handling Materials in the Plant Yard

(*Continued from page 17*)

tion from rain or moisture; third, the activities requiring no protection.

If you will make an analysis of this sort you may be surprised at the result, particularly if you will make the analysis on a "square foot" basis.

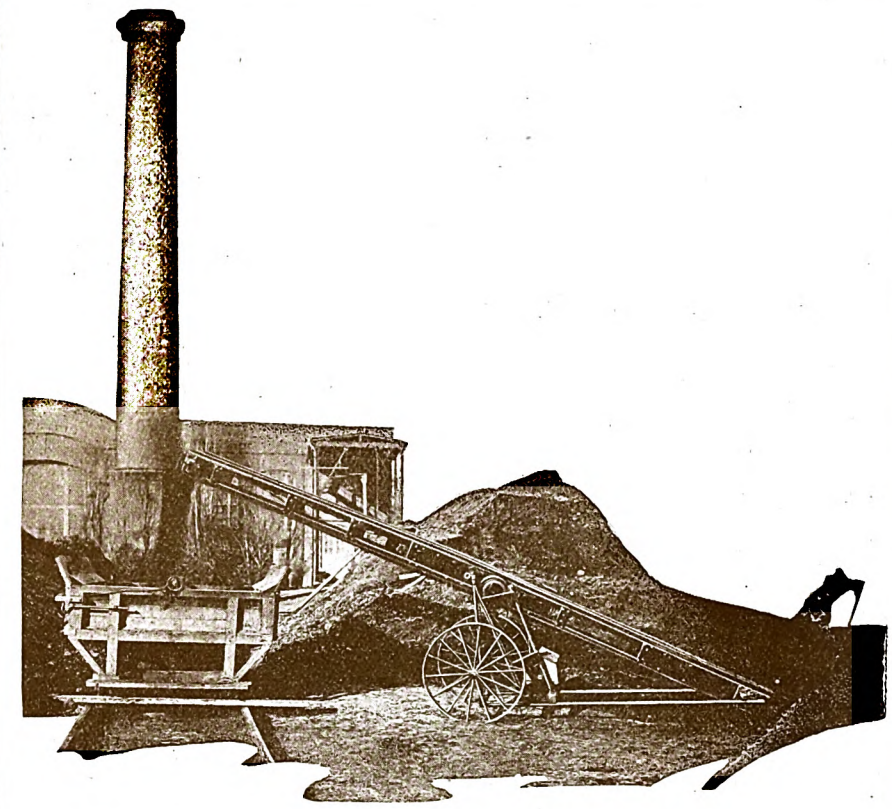
The recollection is very distinct of the first analysis of this sort which came under my own observation. The product involved was an assembled apparatus composed largely of iron castings which required very little machining other than milling and drilling. The production volume was large and the variety large also. shed and racks for semi-finished product and with a complete rearrangement of machines and assembling, this building would serve its purpose for many years to come, in spite of an expected, constant growth in business. And not only did this alteration do away with the necessity of an expensive addition; it also cheapened the cost of the product. It did this in two ways; first, because the improved handling machinery which was installed between the yard and the department was found to operate at less cost in labor and time than the old scheme of lifting and hauling by hand within the department, and



This four-motor electric crane handles 100 tons of coal per hour and is fitted with hopper, crusher and weighing scale.

When this department began to be "pushed for space" the question arose as to what could be done and the suggestion was made of an additional building. First, however, the floor space was gone over and checked up in ten-foot squares to see how it was actually being used. Less than twenty per cent of it was being used for actual production as represented by machining and assembling operations. The remainder was occupied by accumulations of stock in a rough, a semi-finished and finished state, and by "waste space." It was found that with the proper utilization of the adjoining yard with open storage of rough stock and with a second, that in removing the excuse for the huge piles of miscellaneous stock it became necessary to plan requirements more closely, thus reducing materially the investment in work-in-process. Even a third improvement might be cited in that by concentrating the real production activities it was possible to supervise them much more closely.

Especially in machining departments, it will often seem as though every square foot of floor space is being properly utilized. There was a case of this kind not long ago which came to the attention of the writer. In this case there was no accumulation of rough or semi-finished stock paying rent



Cuts Handling Costs 75%

THE Atlantic Coast Electric Railway Co., Asbury Park, N. J., Say—"Four men and your conveyors are now storing aud reclaiming the coal that formerly required 30 men. You can figure our savings by the difference in number of men employed who receive $4 a day for this work."

The Union Seed & Fertilizer Company, Macon, Ga., Say—"It is necessary to load all of our clinkers in cars which can now be done at an expense of about $6 against $25 to $30 without the machine."

The Pendleton Manufacturing Co., Autun, S. C., Say—"We use the Scoop Conveyor for unloading coal, crushed stone and loading cotton seed. Its principal use is in unloading coal from car to truck and it saves us the cost of hand shovelling."

The Imperial Porcelain Works, Trenton, N. J., Say—"We have had two of your Portable Scoop Conveyors at work in our plants for the past year. We desire to express to you our entire satisfaction with this investment."

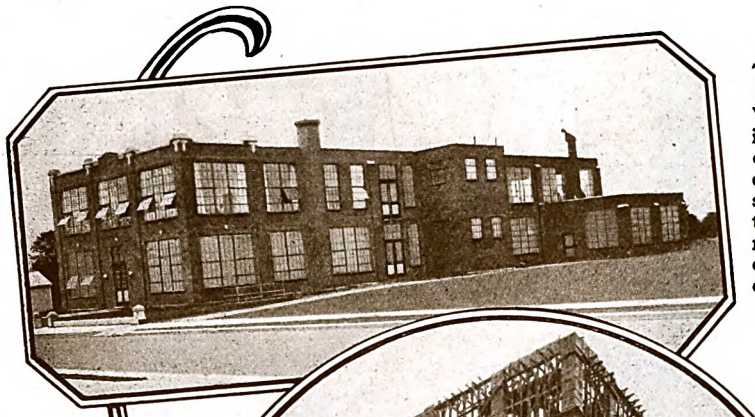
Write for Catalog No. 158

Portable Machinery Co.,
PASSAIC, N. J.

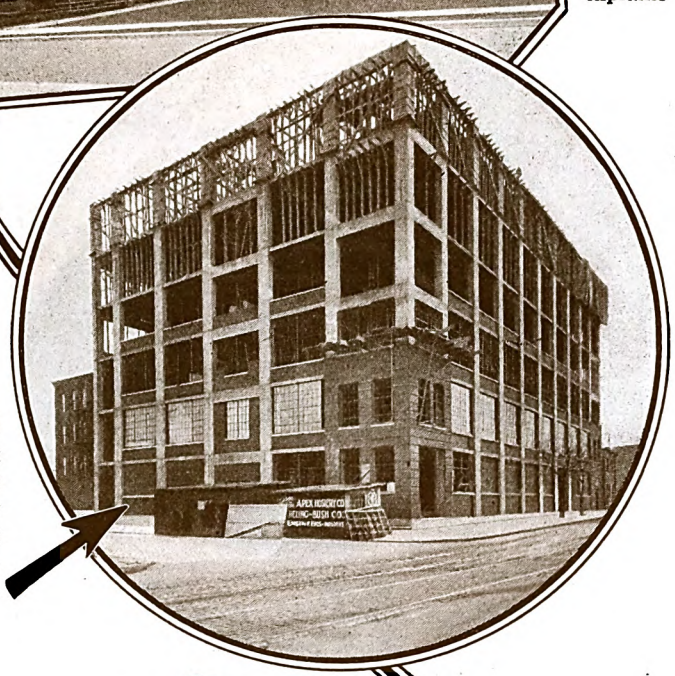
ask any user

THE SCOOP CONVEYOR

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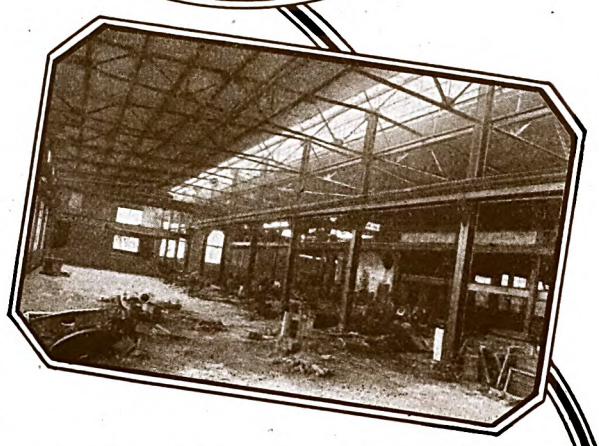


The Royersford Needle Works. Finished in 47 days. Our clients were so satisfied they recommendedus to others,which explains



WHY

we secured the contract to erect the building for the Apex Hosiery Co., Philadelphia.



Foundry Building, Hills - Jones Plant of the Consolidated Machine Tool Co., Wilmington, Del.

Save Time and Money through the Beling-Bush System of Standardized Building.

YOU owe it to yourself and your company to investigate the Beling-Bush Method of Standardized Factory Construction. We can build your new plant or that addition in 30, 60 or 90 days. You'll find our work so high-class and thorough that you too will go out of your way to recommend us to your friends when they want to build. With us you save because of centralized responsibility on plans and construction and in the elimination of a vast amount of time and effort.

If you are considering a new building, write us for our catalog and information. Such an inquiry involves you in no way, yet it may result to our mutual satisfaction.

THE BELING-BUSH CO., INC.

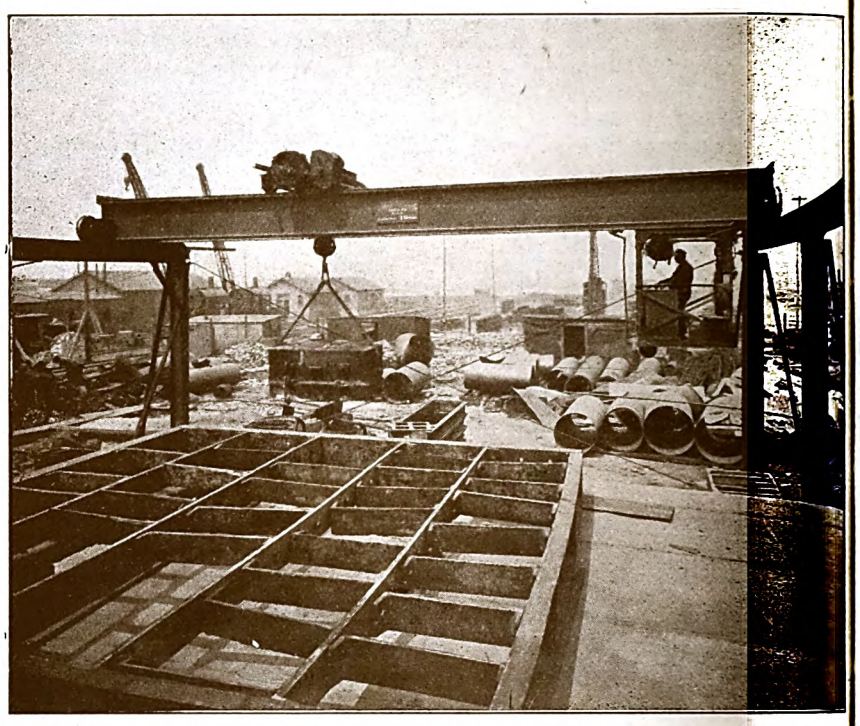
Factory Engineers and Builders

THE SERVICE

Drexel Building Philadelphia, Pa.

for the high class accommodations accompanied by light, heat and power. The machines were arranged in orderly rows with definite aisles for shop truck transportation. One would say at first glance that all of the floor space available was being used. Yet as a matter of fact there was fully a twenty per cent wastage.

your buildings getting crowded you can generally make plenty of room for additional production under the roof of existing buildings, providing that you put your machines as closely together as possible, and make provision for storing in the yard such parts and materials as do not require to be actually in a closed building.



Yard cranes such as the above are indispensable for handling flasks in and out of steel and iron foundries. This ten-ton crane is installed at the Riverside Steel Casting Company, Newark, N. J.

It was impossible to convince the plant superintendent of this fact until he was taken to Detroit and shown the methods of machine arrangement employed in the Ford plants. Ford gets three machines in the floor space ordinarily occupied by two. One who is accustomed to the arrangement of machines in the average department at other plants would say that the Ford plant leaves scarcely enough room between the machines for the workers to move about comfortably. This, however, is largely a matter of becoming accustomed to conditions. One of the Ford principles is that a machine operator is employed to operate a machine, not to take unnecessary steps. The work moves and the men stand still. Putting these machines so close together not only eliminates shop pedestrianism, but also shortens the total length of path over which the product must pass in its journey from its initial to its completed state.

"But," you will ask, "what has all this to do with the plant yard?" It has a whole lot to do with it. When you find

A course of this kind would not be practical were it not for the great variety of handling machinery that we have available today, machinery that will run out into the yard for us and fetch and carry that which we require.

There is an apparently endless list of materials that are at home in the modern plant yard. Coal, coke, sand, pig iron, scrap iron, limestone, pipe, bar steel, structural shapes, brick, sheet iron, lumber, ingots, steel and iron castings, foundry flasks, and dozens of other materials claim the plant yard as their habitat. As many varieties and types of mechanical handling appliances are available for giving these things motility. Every engineer and executive who has anything to do with production or with planning the arrangement of factories or with arriving at decisions regarding plant extensions should be familiar with these various types of handling equipment which make open air floor space a close-knit adjunct of the enclosed production department.

(Continued on page 66)

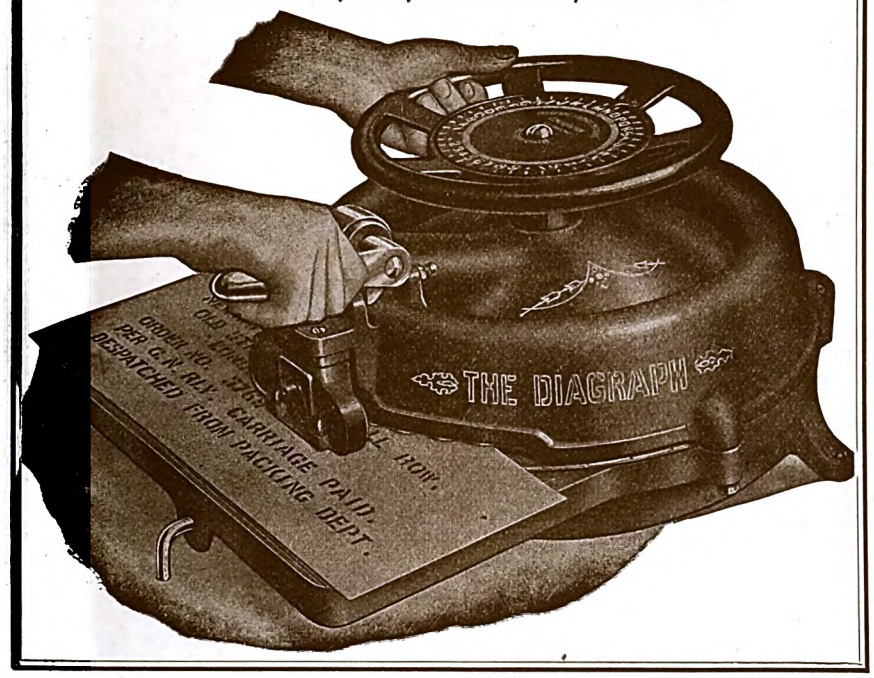
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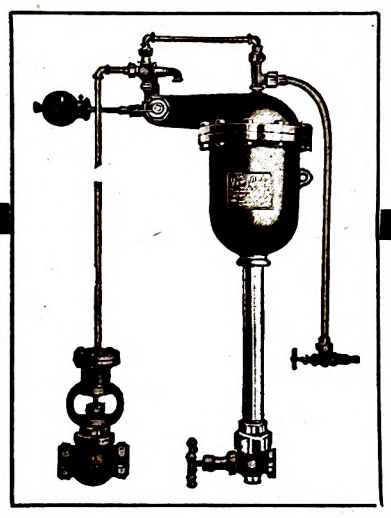
DIAGRAPH
YOUR SHIPMENTS

The Diagraph cuts legible address stencils for marking all packages, boxes, bags, cans, crates, castings and similar material. Addresses do not blur, wash or rub off. Safer than tags. A practical insurance against lost and delayed shipments.

Try one free in your own shipping room—price complete with all supplies, only $110.00 delivered, in either housed or open models. Order one on trial—no obligation to buy—we pay all charges.

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Branches in all principal cities. See phone books.





VIGILANT
Feed Water Regulator

—what power man would fail to insulate

HIS STEAM LINES

certainly none—then why gamble with anything as unsafe and uncertain as hand regulation of feed water which may waste as much fuel as the unprotected steam line.

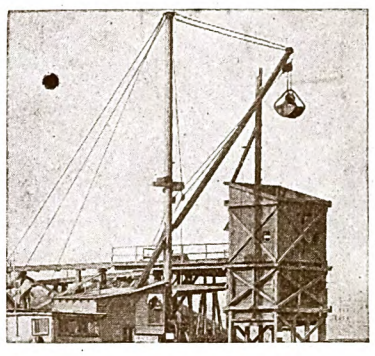
Play safe. Put your water level on an automatic basis by installing Vigilant feed water regulators. Correct boiler feeding will save you fuel expense sufficient to pay for the regulator in a short time.

Vigilant Feed Water Regulators hold the water level at a fixed point, under all operating conditions and at all boiler loads. Their operation depends upon gravity and not upon expansion tubes, floats or diaphragms. That is why they stand in the foremost rank for reliability. Write for 52 page catalog.

The Chaplin Fulton Mfg. Co.
28-36 Penn Ave., Pittsburgh, Pa.

MECHANIZE
MATERIALS HANDLING

Efficient Equipment Saves More Than Its Cost!



A Permanent Installation Requires Not Only Good Equipment But "Know How" As Well

Haiss is a specialist in ways, means and equipment for handling *loose materials*, (coal, coke, sand, building materials, etc.)—and has been just that for 30 years. Haiss Engineers have the "know how" that enables them to recommend handling equipment that cuts cost to the bone. You can profitably apply this engineering skill to your own need—there's no obligation.

Haiss Builds

Mechanical Equipment Complete for Unloading and Storage Plants

Bucket and Flight Elevators

Mast and Boom Hoisting Plants

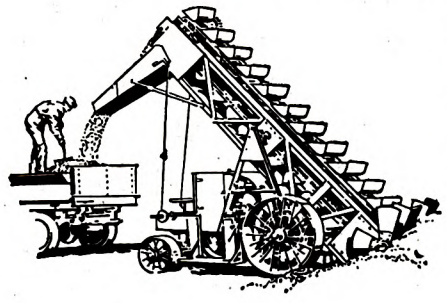
Clam Shell Buckets

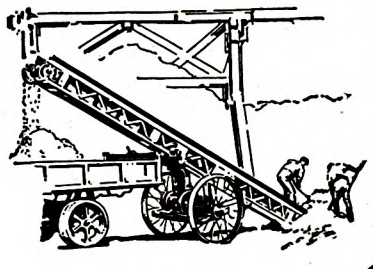
Cable and Automatic Cars

Screens, Chutes, Hopper Gates, etc.

Haiss Equipment, too, has something to it. Designs have been worked out which make the various units long-lived and trouble-free. Even in simple things the "know how" adds a measure of efficiency.

Portable Loaders and Belt Conveyors Have Great Flexibility of Application





Rehandling from storage piles is often a more practical job for a simple portable loading machine than for more elaborate equipment. The Haiss Machines have ample capacity for almost any requirement and the added virtue of lower investment cost and economical operation. You can have anything up to a full-automatic loader, where the operator merely pulls control levers.

Let Us Show You How to Save Money

The Geo. Haiss Manufacturing Co., Inc.
146th St. & Canal Place, New York
Established 1892
Representatives throughout the world

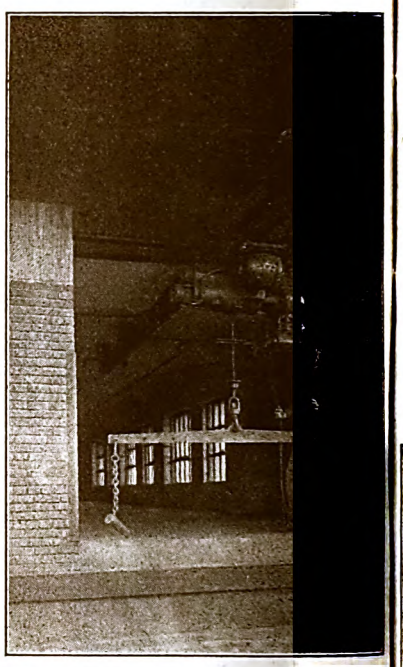
The Geo. Haiss Mfg. Co.
New York, N. Y.
Please send me your catalogs on Equipment for handling .....
.....
Name .....
Address ....

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(*Continued from page 64*)

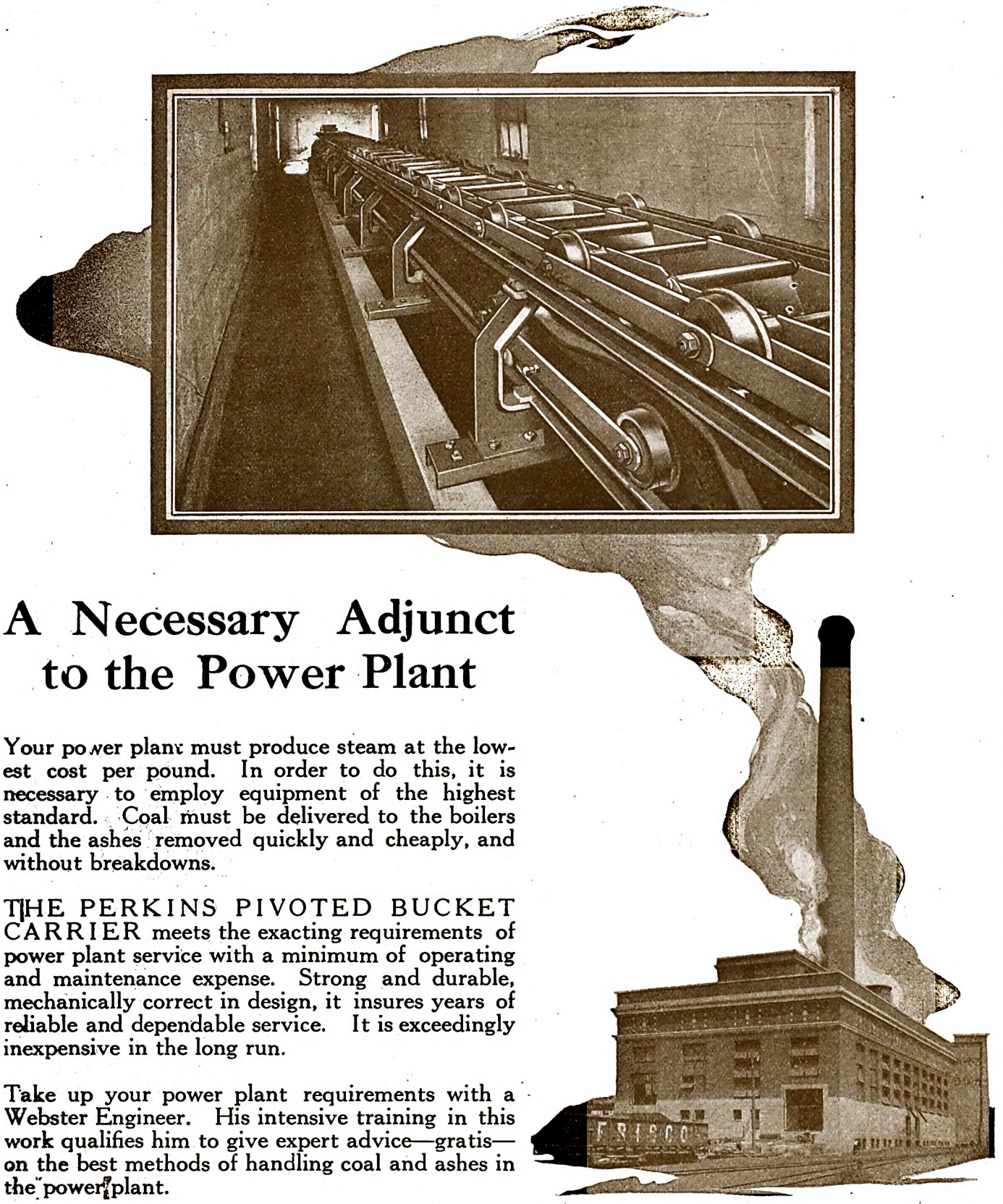
But in addition to this the engineer and executive must go further in his study and be familiar with the modern trend or tendency in the layout of plant operations. If the yard is to be knit into the plant as a whole it must be done under the principles governing the flow of product in the process as a whole. And so just a word about this trend.

There was a time not long ago when the ingenuity of the designer, inventor, superintendent and plant manager was centered in the increase of productivity of individual machines. A great deal of time and thought was given to cutting speeds and feeds, to the perfection of automatic and semi-automatic production tools, to multiple tooling and the like. As a result of this intensive centering of thought upon the individual machine, these machines have reached a high state of perfection. It is no longer possible to improve them very greatly, even with the expenditure of much time and thought. So we must look elsewhere for our economies. Up to date plant managers are finding these possibilities for further economy to lie in the knitting up of the process as a whole through mechanical transportation. They have found that there have been far greater losses which have occurred between the machines than at the machines themselves. They have found that there is a fruitful field for cost reduction in eliminating these losses, a field so big and rich with possibilities that it will keep them busy cultivating and harvesting it for the next decade or two. And so the modern plant manager spends most of his time today thinking about the process as a whole instead of the individual machine. In so thinking, his criterion must be overall efficiency as distinguished from individual efficiency. Oftentimes it will pay him to sacrifice perhaps ten or fifteen per cent on an individual machine or operation in order to make this machine or operation better fit into the process as a whole and thus increase overall efficiency. It is this new system of thinking that promises so much for the development of future American industry, and which enables



Where the factory meets the yard, transportation is assured by this electric hoist equipped monorail which lifts huge bales of paper into a printing plant.

(*Continued on page 68*)



A Necessary Adjunct to the Power Plant

Your power plant must produce steam at the lowest cost per pound. In order to do this, it is necessary to employ equipment of the highest standard. Coal must be delivered to the boilers and the ashes removed quickly and cheaply, and without breakdowns.

THE PERKINS PIVOTED BUCKET CARRIER meets the exacting requirements of power plant service with a minimum of operating and maintenance expense. Strong and durable, mechanically correct in design, it insures years of reliable and dependable service. It is exceedingly inexpensive in the long run.

Take up your power plant requirements with a Webster Engineer. His intensive training in this work qualifies him to give expert advice—gratis—on the best methods of handling coal and ashes in the power plant.

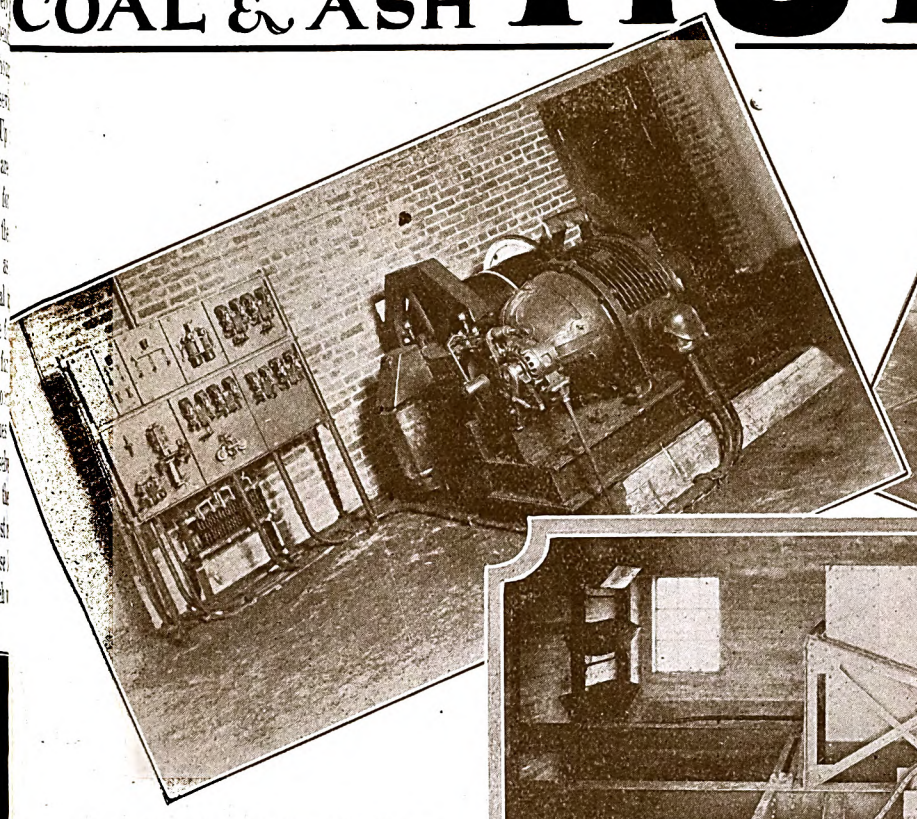
THE WEBSTER MFG. COMPANY

4500-4560 CORTLAND ST., CHICAGO

Factories Tiffin, O. *and* Chicago-Sales Offices *in* Principal Cities

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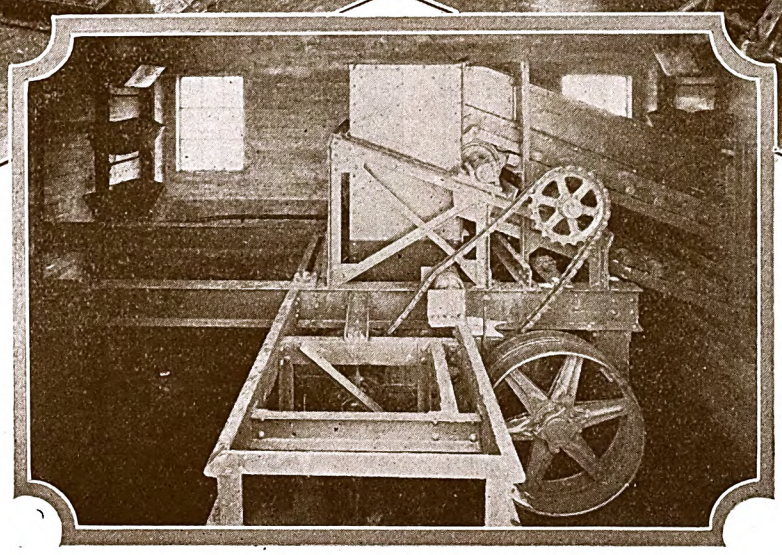
COAL & ASH HUNT HANDLING



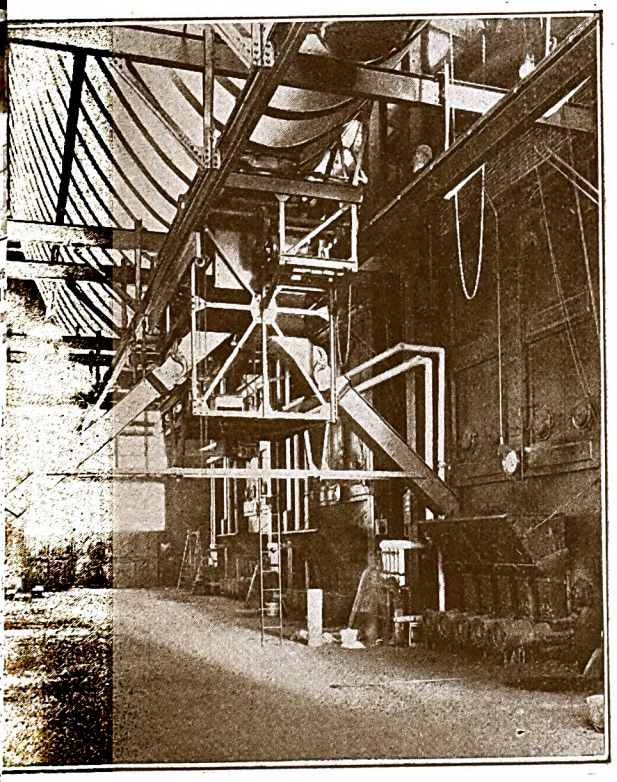
Control Panel and Hoisting Machinery for Skip Hoist Operated by push button switch located at most convenient point.



Double Run of Conveyor over Coal Bunker. Coal is discharged directly into bunkers from lower run of conveyor.



Apron Conveyor Feeding Coal into Coal Cracker. The apron type insures a more even flow to the cracker.



Electrically Operated Traveling Weigh Larry. Everything controlled from operator's platform. Valves opened and closed; coal weighed and registered by type register beam.

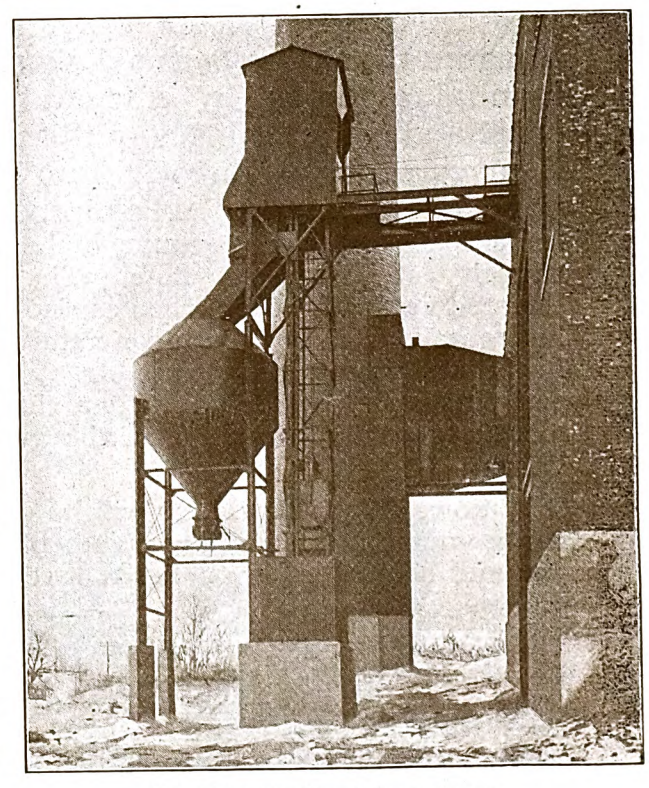
Power Costs Are Cut Here

THE evident advantages to the Utica State Hospital power plant upon operating economy and efficiency through Hunt Cost cutting equipment, shown here, cannot be overestimated.

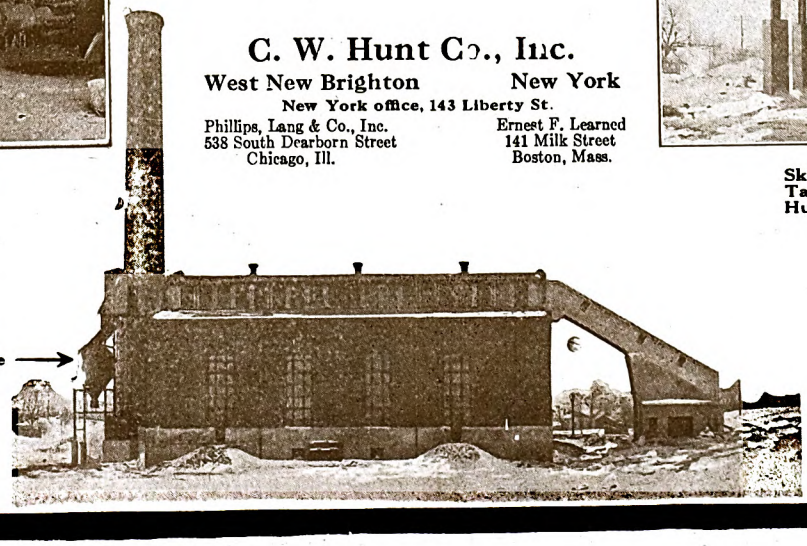
From the time coal is received, its energy utilized and until it is carted away as ashes, every operation in its conveyance to the stokers and ash bin represents the strictest economy, combined with the utmost dispatch and the minimum of labor.

The same efficiency and economy can be effected in **your** power plant. Let Hunt Engineers prepare a layout.

C. W. Hunt Co., Inc.
West New Brighton New York
New York office, 143 Liberty St.
Phillips, Lang & Co., Inc.
538 South Dearborn Street
Chicago, Ill.
Ernest F. Learned
141 Milk Street
Boston, Mass.



Skip Hoist handling Ashes to Storage Tank. Ashes are delivered to Skip by Hunt industrial Railway cars.



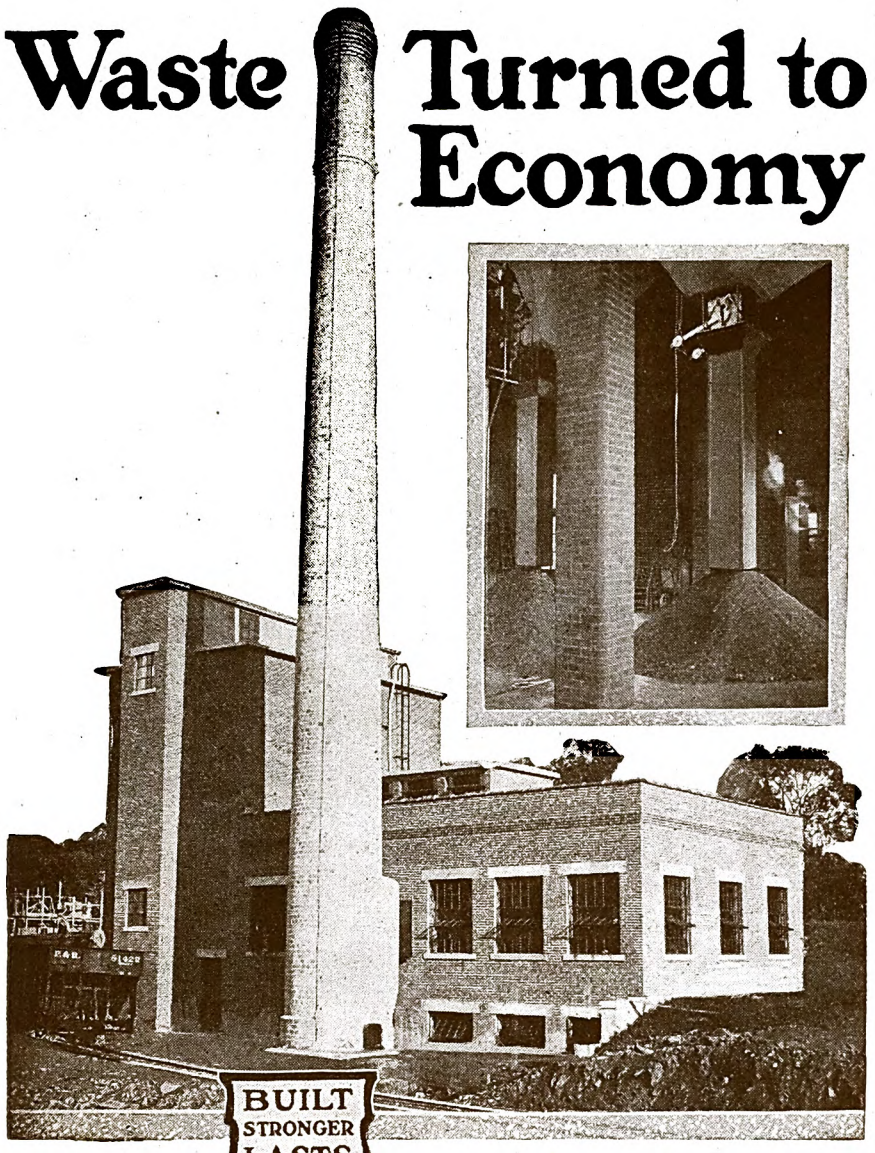
Ashes discharged here →

← Coal received here

General View of Utica State Hospital Power Plant

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Waste Turned to Economy



Power Plant of the Ball and Socket Mfg. Co., West Cheshire, Conn.

Imagine the saving over old, wasteful, manual methods by efficient G-W coal handling machinery in this plant! Coal cars dump directly into truck hopper, from which a reciprocating feeder loads an elevator conveyor having a capacity of 50 tons per hour. The coal is elevated vertically 50 feet, then carried 30 feet horizontally over the 200 ton concrete bunker. It is distributed to the proper bin by a rack and pinion gate, and fed directly to the boiler room floor by two down spouts with regulating valves.

G-W Power Plant Engineers will be glad to study your coal handling requirements with you and help effect economies that reflect in profits.

The Gifford-Wood Company specializes in elevating and conveying machinery for all lines of industry, including coal pockets (wood, steel, concrete; rectangular, silo), screens, hoppers, locomotive coaling stations, elevating and conveying equipment for ashes, stone, sand, gravel; pivoted bucket carriers, warehouse conveyors, portable conveyors, wagon loaders, car unloaders, friction clutches, hoists.

MAIN OFFICE AND WORKS: HUDSON, N. Y.
New York: 50 Church St. Boston: 24 Milk St.
Chicago: 565 W. Washington St. Buffalo: Electric Bldg.

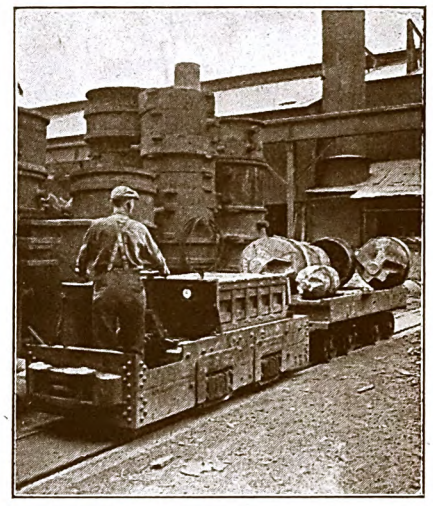
Gifford-Wood Co.

MATERIAL HANDLING EQUIPMENT

(Continued from page 66)

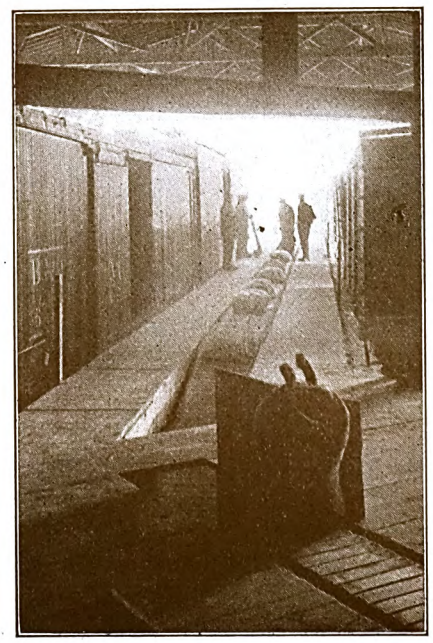
the plant yard to be such a valuable adjunct to the manufacturing departments.

It is for this reason that we are publishing in this article, the first of a series dealing pictorially with the possibilities of plant yard transportation. The subjects to be covered are so numerous, so interesting and so full of profitable suggestions that it is impossible to cover them fully in a single



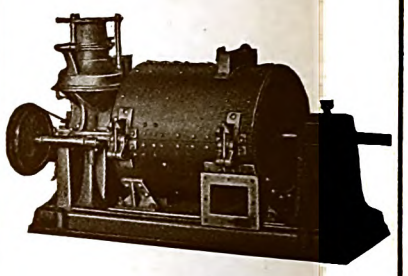
Electric storage battery locomotives push and pull loaded cars through the yards of this large foundry.

issue. Millions of tons of materials are moved and handled about the yards of the plants of our country in the course of a year. On the average, it is perfectly safe to say that there is still room for a fifty per cent improvement with a total resultant saving to the industries of many millions of dollars annually. It is with the hope of suggesting means of reclaiming some of these lost millions that we are presenting the practice of the most up-to-date plants.



Wood slat conveyors extending from the plant into loading sheds enable cars to be loaded with the least expenditure of time and money.

Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

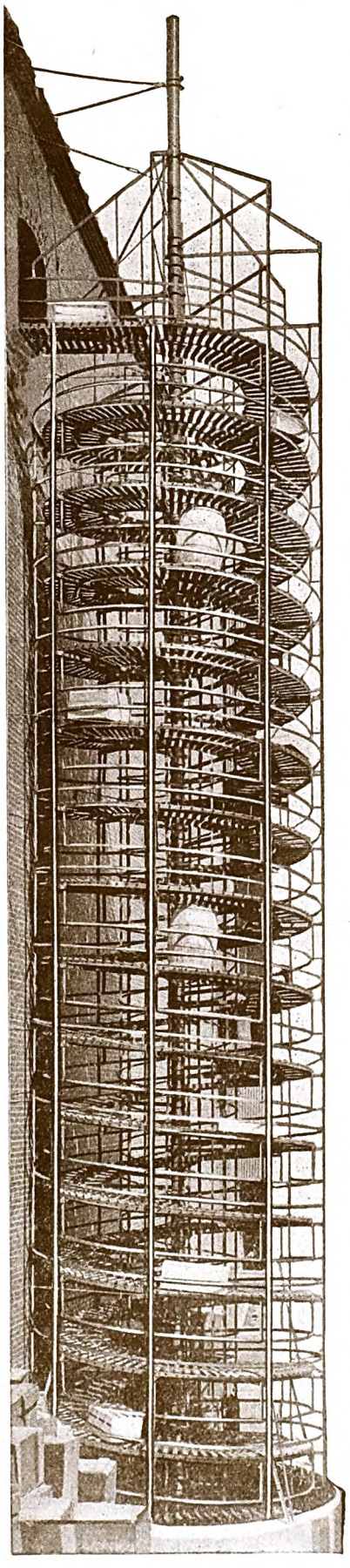
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AERO PULVERIZER COMPANY

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From Top Floor to Shipping Platform with no Expense for Power



TOWERING alongside the warehouse it stands, a vast coil of steel and iron. Day in and day out, hour after hour, boxes and barrels and crates glide down its length from packing room to shipping yard. No hand touches or guides them in transit. One man loads at the top, another unloads at the bottom: natural gravity does the rest.

It's a Mathews Gravity Spiral Conveyer, operating at no expense for power. Gravity—the Earth's attraction—supplies power free. Goods placed on its steel, ball-bearing rollers are carried downwards quickly, surely and economically.

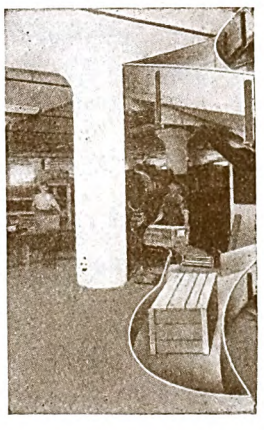
Mathews Gravity Conveyers fill the conveying needs of almost every industry. There are many types, including chutes, automatic elevators, spiral and straight carriers adapted to practically any product. They move dairy products or glassware, boxes, trays of all sorts—from floor to floor, from machine to machine, around corners, over obstacles, across courts, from factory right into freight car. They are portable or permanent, serving for light or heavy work indoors and out.

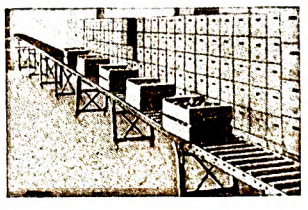
Compare the Mathews Gravity Roller Conveyer with other methods of conveying and you will realize its economy. It saves miles of walking and hours of time spent in trucking or running elevators. It economizes floor-space, avoids wear and tear on flooring. Delays, breakages, mistakes are eliminated. It conserves labor, speeds up production and cuts overhead.

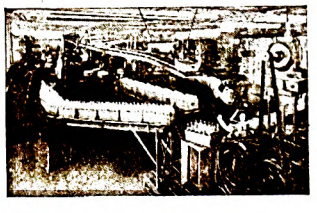
The Mathews Gravity Carrier Company are pioneers of gravity conveying. Fifteen years, devoted exclusively to the manufacture of gravity conveyers, have enabled this company to develop many special features that make for greater durability and efficiency of service. Our engineers are at the disposal of all who have conveying problems to solve. Write for particulars, or have a trained man call.

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103 Tenth Street, Ellwood City, Pa.

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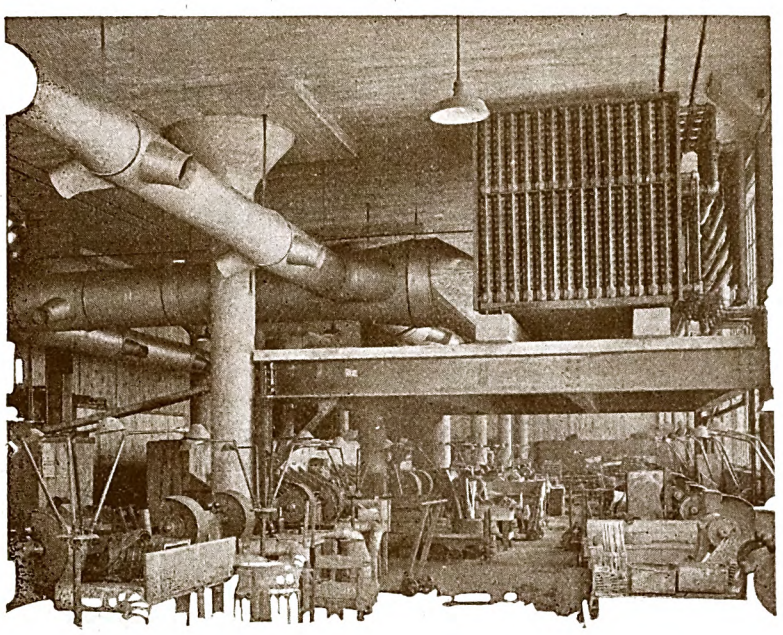








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MANY a product would be better—many a handling operation would be carried out at reduced cost—if executives and managers would give more attention to the use of moving air supplied and controlled by Clarage-Kalamazoo Fans and Blowers.

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Gas production is being increased, blowing periods reduced.

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Used for mechanical draft, Clarage-Kalamazoo Fans are boosting boiler capacity and efficiency.

Pure air from out-doors properly washed, heated, and humidified is improving workers' efficiency and increasing production.

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CLARAGE-KALAMAZOO Multiblade Fans

This book—

tells how to put air to work

—ask for it



Roofing the Old and the New Buildings

(*Continued from page 14*)

iron" of early days gave way to the cheap quickly-made Bessemer steel which proved to be extremely short lived for exposed sheet metal work.

Extensive, careful experiment discovered why some irons or steels rust so quickly while others last for many, many years. The reason is electrolysis, due to variation in the composition of the metal. Some parts of the sheet may be almost pure iron, while impurities seem to gather in patches or in tiny points where rust begins at once and quickly eats tiny holes in the metal, through a process of electrolysis which causes corrosion or extremely rapid rusting of the impure spots. Today, iron or steel made by the open hearth process is the only kind used to any extent for exterior work, and this usually gives excellent service; the character of the metal being different—much more even in composition.

Given a well-laid sheet iron or sheet steel roof, in which the metal itself is of the best, and in which the under side has been properly protected, there is just one word which sums up the whole question of service and long life—Paint. On this all-important subject, the following extract from the instructions of a large manufacturer of roofing and siding sheet metal is well worth quoting:—

"Many different types of paint have been offered for the protection of metal buildings. Some of these are almost worthless, while others have, in most cases, given satisfactory results. Among the latter may be mentioned natural oxide of iron ground in pure linseed oil. Recent careful investigations, however, have demonstrated conclusively that the very best results in painting unprotected sheets are obtained by using as the first coat, red lead (containing not less than 85 per cent. $Pb_4\ O_3$) ground in pure linseed oil. For the second coat part of the red lead may be replaced by carbon black or some other inert pigment, and the third or top coat may be any good moisture excluder, such as graphite. It is important that the first coat, or the coat next to the bare metal, be of a basic nature, and red lead has been found to be one of the best basic pigments.

"In painting galvanized sheets, inasmuch as the zinc coating is electro-positive to the base material, which is in itself an additional protection, it is perhaps not so important that red lead be used, and first quality iron oxide ground in linseed oil is, therefore, recommended for painting galvanized sheets. It is a well known fact that if paint is applied to new galvanized sheets, it is almost certain to peel off. It is, therefore, important that the surface be slightly roughened before applying the first coat of paint. This is best accomplished by exposing the sheets to natural weather conditions for a period of from six to twelve months, before painting.

"It is economy to use only good grades of paint. Always use good brushes, rub the paint well on, and do not spread it out too thin. Roofs and sheet metal work should be kept well painted—the intervals depending largely upon climatic conditions. After the initial coats, as above described, paints may harmonize with any desired color scheme."

A roofing material which is finding increasing favor of later years is the cement tile. Being a manufactured product, it is easier to handle and to apply than the old time slate roof (though the latter is by no means in the discard, as yet). Furthermore, the several makes of cement tile now available were conceived with a definite purpose: to supply the well-known permanency of a tile roof, without the excessive cost hitherto associated with that type of roof.

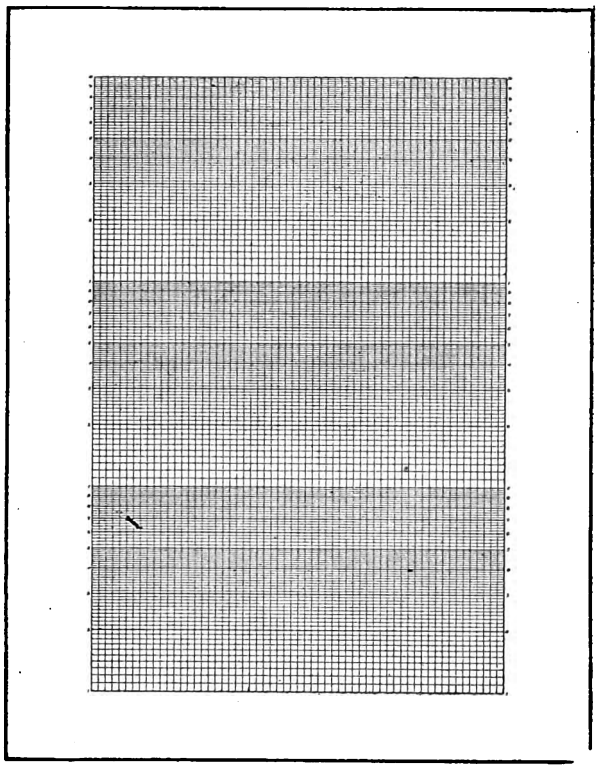
All of the different roofing materials so far considered, are applicable to surfaces

(*Continued on page 72*)

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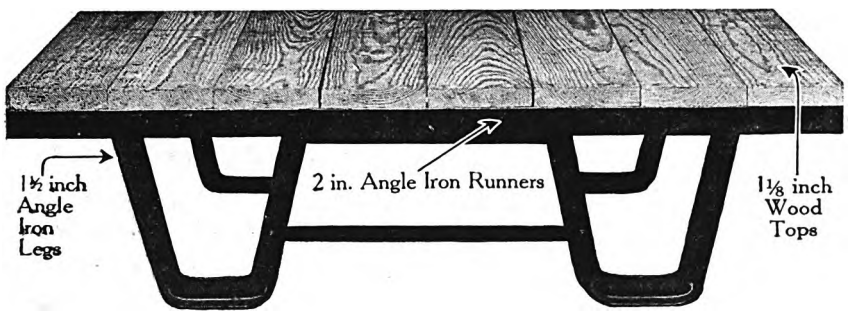
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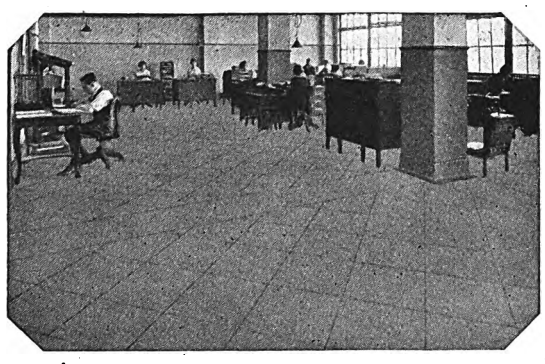
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(Continued from page 70)

which have sufficient pitch to drain rapidly. When we come to large expanses of flat, or nearly flat area, however, the problem is a different one. In such cases, shingles are out of the question, as are tiles. It is perfectly feasible to use sheet iron or steel, soldering the individual sheets into one immense sheet—though this process is not used as extensively as it was a decade or two ago. From the standpoint of both first cost and satisfactory service, the built-up type of roof has found increasing favor for this purpose. Examples of three different kinds of built-up roofs are shown among the illustrations accompanying this article. Such a roof may be of waterproofed concrete on steel; of built-up layers of asbestos felt and asphalt; or of asphalt alone, over concrete or even over wood. The least expensive in first cost is the felt roof with tar and gravel, over roofing boards; while the nearest approach to freedom from repair lies with either the asphalt or the asphalt-asbestos built-up roof over concrete.

To dismiss the various kinds of prepared roofing, with the brief mention accorded them earlier in the course of this discussion, would create the impression that these are of merely secondary importance. On the contrary, a very large proportion of new buildings are being roofed without recourse to the old standby materials; while the whole immense field of operations in reroofing existing buildings depends primarily upon these newer manufactured roofings.

The earlier forms of prepared roofings sought lightness, ease of application, absolute protection against water, and a surface that would both resist water and stand up under the heat of the sun's rays. These characteristics were obtained by impregnating a felt base with pitch or asphaltum, and in some cases by surfacing with a rubberized compound.

With lightness and ease of application attained, the question of fire-hazard began to receive attention. And here the vision of some farsighted manufacturers did its part; because only through the foresight and energetic work of these manufacturers was as-



A New SARCO costs Less than to Repair Other Traps

The numerous parts in both float and bucket traps wear out—are constantly needing repairs, replacement and adjustment. For example, the float. To put in a new float alone costs around $12.00 besides the labor. And the cost of other new parts is often almost as high.

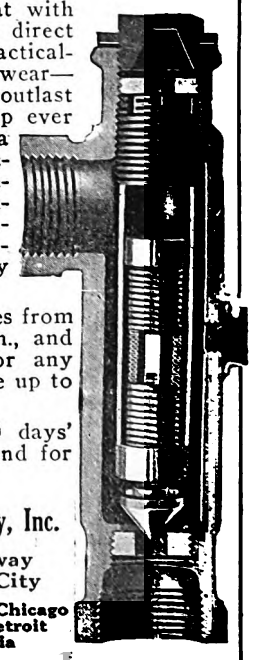
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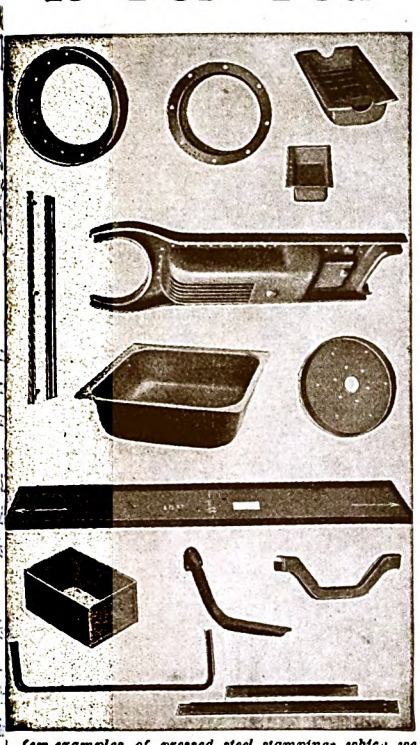
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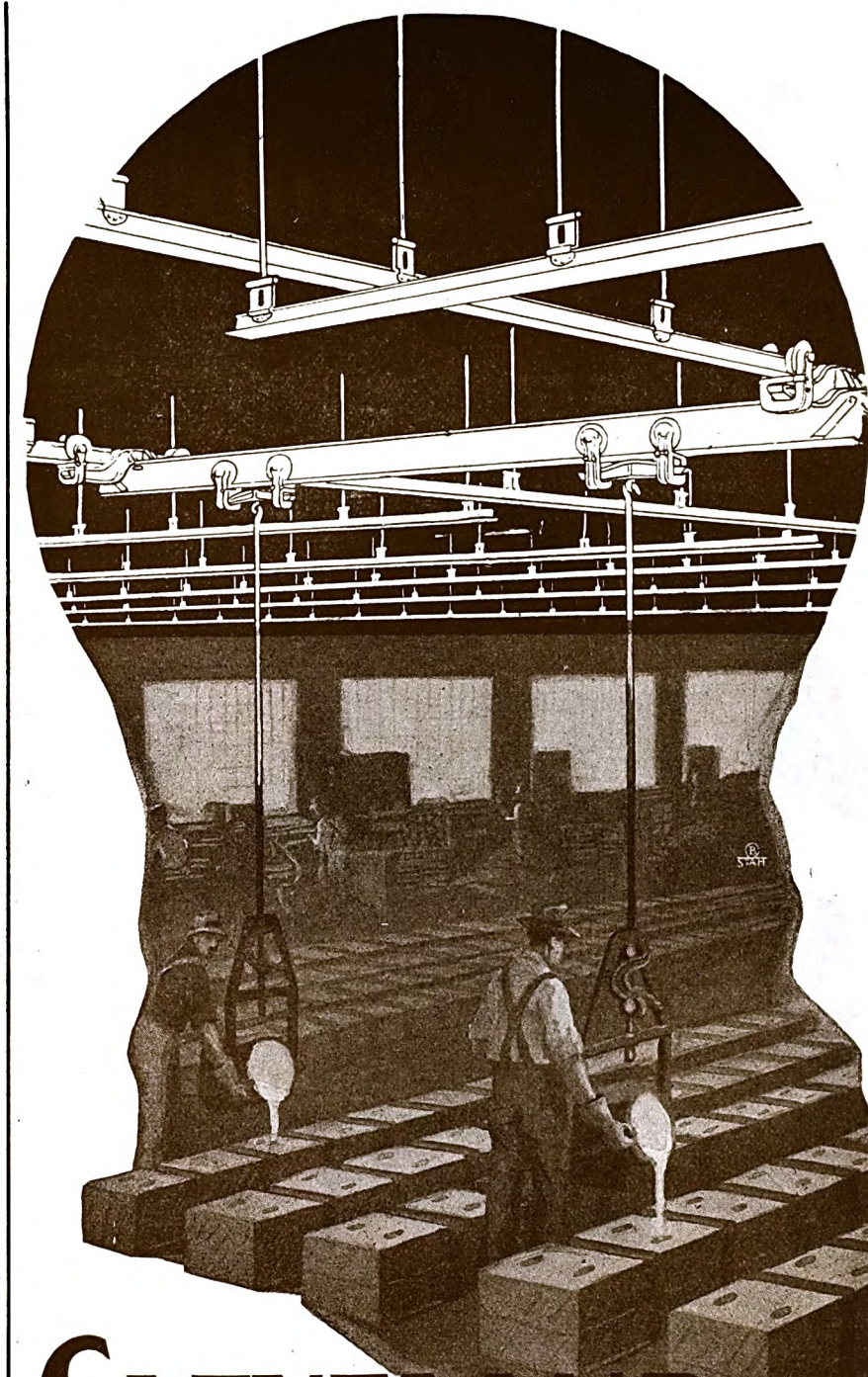
TRUSCON ALLOY PLATFORMS STEEL

bestos—that marvelous product of nature—made available for use. But a few decades ago, asbestos was a little-known curiosity; today, besides its manifold other uses, asbestos is practically the foundation on which is built the whole industry of fireproof manufactured roofing.

Eliminating from consideration the flat roof of large area—which has been discussed here, a few paragraphs back—whether the building under consideration be a big factory, built to endure, or a small temporary tool house or construction shed (providing only that the roof has a pitch of at least 1½ inches to the foot), there is available a ready-to-lay roofing that will meet every ordinary requirement. Specific cases, such as in some chemical plants, or the like, where chemical fumes must be reckoned with, may dictate the choice of tiles or sheet metal; but otherwise the ready-to-lay roofing can compete on terms of equality with any other type.

It is the ease of application, and the comparatively low cost of installation, that has made this type of roofing assume such importance in recent years. But more than that, the manufacturers of these prepared roofings have developed a field of great importance to the factory owner. Realizing that a large element of the cost of re-roofing a building lay in removing the old roof, far-sighted manufacturers are pointing out that their product can be applied right over the old, worn-out shingles—and not merely suggesting, but proving that it works.

The emphasis which is placed upon the limitation of the numbers of immigrants as a means of restricting the labor supply is the outgrowth of a wrong conception of the economic consequences of such a policy. A scarcity of labor which unduly forces up wages is not socially defensible merely because the nominal wages of a large part of the workers are made higher than they would be without the restrictions upon numbers. The extra costs are widely distributed and are borne in large part by the wage-earners themselves. — *The Guaranty Survey.*



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Americanization in Industry

BY FRED H. RINDGE, JR.

THE term "Americanization" is not altogether a happy one. It smacks of compulsion and paternalism and is therefore resented by our foreign people and by the countries from which they come. However, it is terse and generly understood; so we continue to use it. We are coming to realize, moreover, that the most *thorough* Americanization can be achieved in industry as well as in the 3,000 communities boasting 100 or more foreigners, by *attraction*, rather than by compulsion. We are learning that we can even Americanize more *rapidly* when we have an intelligent appreciation of the gifts as well as the problems brought by those from other lands.

Graham Taylor well says: "Let us fraternize with our foreign-born neighbors and affiliate their great racial organizations. Let the widest and most sympathetic hearing be given by the English-speaking Americans to the expression and interpretation of the spirit and aspirations of all foreign-born and foreign-speaking peoples among us. Let the press give widest publicity to their struggles here and abroad for liberty and progress. Let their spokesmen be invited to speak at American patriotic meetings to interpret them to Americans, while America is being interpreted to them. Thus through our own and their own speech and song may we best impress and be impressed with the worth and glory of American citizenship."

If our dealings with foreign employes in the great industries could be based on ideals like these they would be far more effective!

There are approximately 14,000,000 aliens of 35 different races speaking 54 languages in America today—not to mention 22,000,000 more of foreign parentage. What a challenge! Some industries in America have as high as 80 per cent of their employed force foreign-born. The foreigners do seven-tenths of the bituminous coal mining, seventy-eight per cent of all the work in the woolen mills, and nine-tenths of the labor in the cotton mills. They make nineteen-twentieths of all the clothing, more than half the shoes, and refine nearly nineteen-twentieths of the sugar. I visited one large industry recently which employed 20,000 workers, more than half of them foreign. Yet that plant's entire Americanization program consisted of four small classes in English. Such amateur tinkering with a great problem is unworthy of American business.

Much of the Americanization problem must be solved in the realm of industry. But we will *never* solve the problem by a few English classes and an occasional scream of the American eagle in a noon-hour shop talk! What the immigrant laborer needs is fair treatment, decent working, living and leisure conditions, reasonable hours and wages, and a little common-sense appreciation of his qualities as a *man*, rather than contemptuous remarks as to his inefficiencies as a "wop" or "Polak!" As Theodore Roosevelt once said: "We must exactly reverse our former policy. Let us hereafter treat each immigrant not as a labor unit, but as the possible father of the American citizens with whom our children and children's children are to inherit the land!"

We should begin with a different kind of reception committee than we now permit at ports of landing. The immigrant's first impression are formed by his contact with grafting porters, taxi-drivers, hotel runners, fake employment agents, dishonest bankers, sharks and radical agitators. No wonder he comes to our shops and mines sore and suspicious! How important it is therefore that our factory employment departments should at once impress him

(Continued on page 77)

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The Author

has served the New Haven Railroad as superintendent of power; the Board of Estimates and Apportionments of the City of New York as expert engineer for municipal plants; and, during the war, the United States Shipping Board Emergency Fleet as power expert. In the public utility field he established a record for economical operation, both on electric railways and in central stations, his pioneer work for the Penn Central Light and Power Company particularly receiving much attention.

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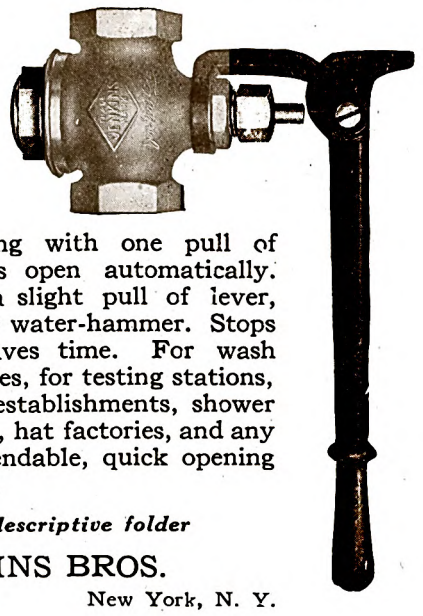


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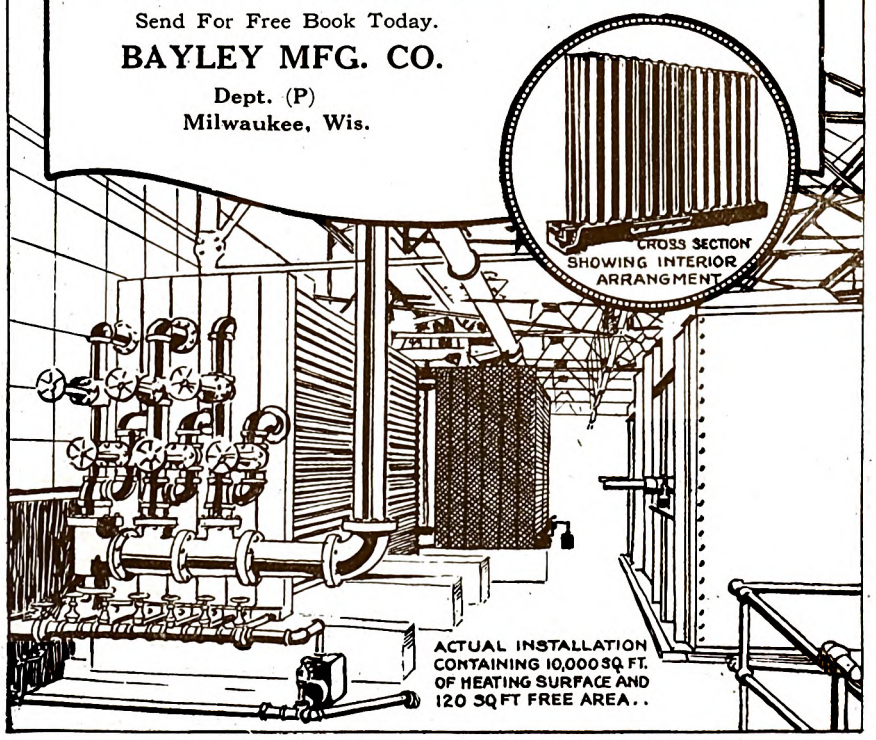
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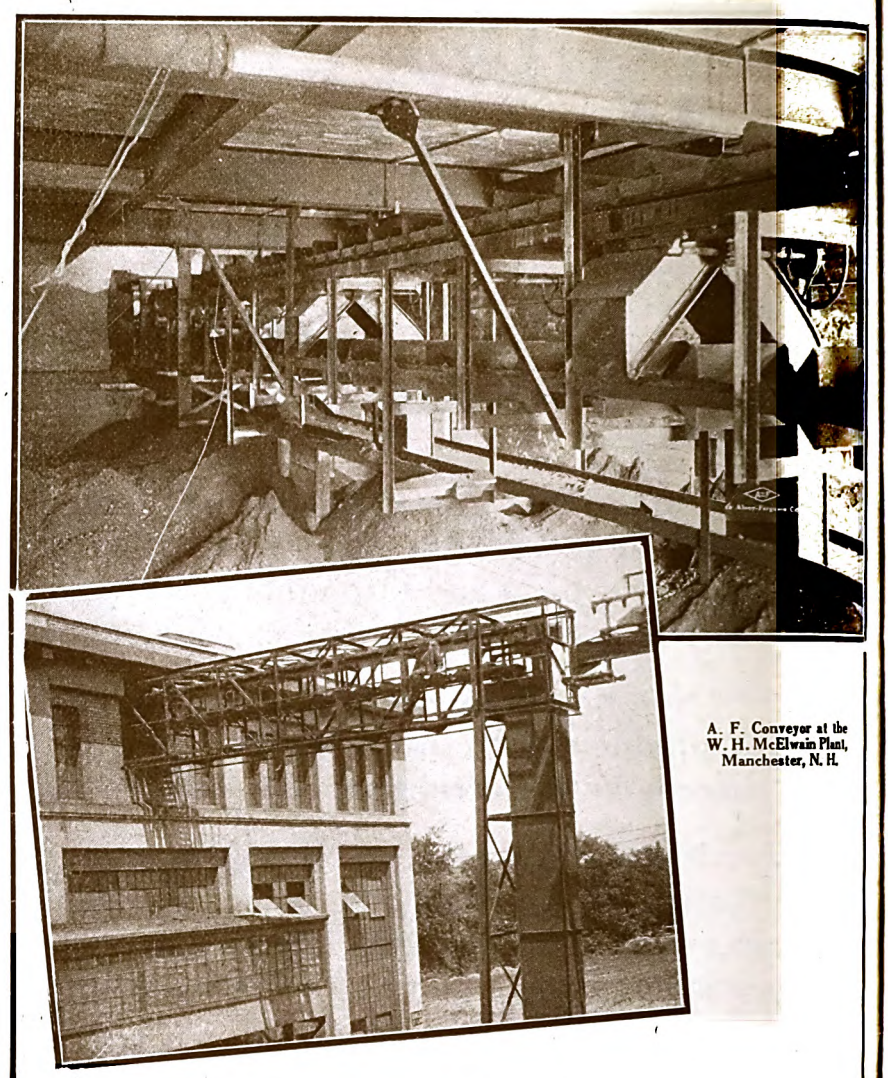
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(*Continued from page 74*)

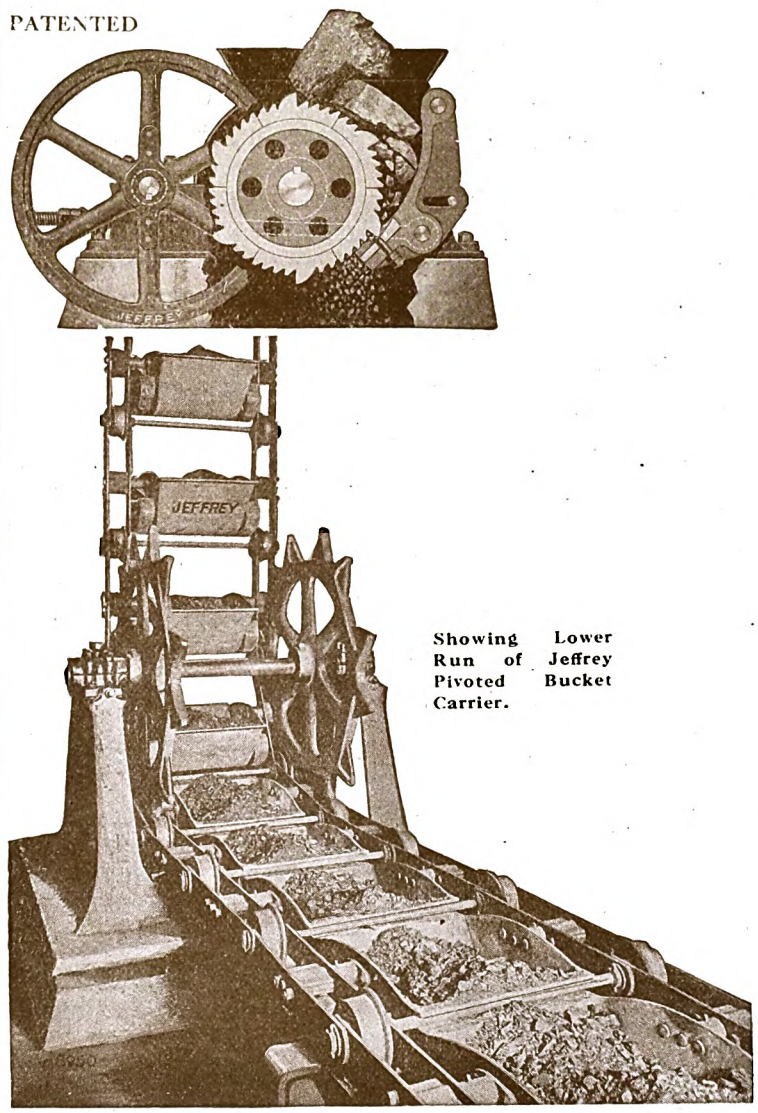
differently! There he should find sympathy, understanding and friendliness, which will at once tend to breed an attitude of loyalty and efficiency. Such treatment will pay in dollars and cents! And after he gets to work the foremen should look upon him as an asset rather than a liability, encourage and help in his new job and make him feel at home. Is that too much to expect in this age, when the leader rather than the driver of men is so much needed? Every alien who arrives in the U. S. A. has come because he believes America is a better place to live and work than his homeland. Are we going to disappoint him?

Early in the game of making his way in America, the immigrant, through ignorance and misunderstanding, is made to feel the hand of the law. He has heard a great deal about the Declaration of Independence and the Constitution, but it is difficult for him to make their ideals jibe with the treatment he receives at the hands of the police and minor courts. Knowing little of the language, he is always at a disadvantage and the interpreters are all too frequently unreliable grafters. Thus he may again have disagreeable experiences which it will take years to efface. Similar treatment is often received in the shop, when the boss curses him because he does not understand. Some of the first English words he learns are therefore swearwords!

If immigrant workmen possess any national ability, it is generally suppressed. Again and again I have met men who had been engaged in for years in most menial labor in an industry, but who spoke fluently several different languages. All they needed was encouragement, a chance for self-expression, a little English instruction and they would have proved invaluable assets. As it was their ability was unrecognized and unused. Many of them have come from lands steeped in rich history and tradition, and with an appreciation of art, literature and music, but all too often we repress or kill it. Over in Italy last year a returned immigrant said to me: "The trouble with America is that hardly any one there appreciates art. Here even the common people love art." I realized better what he meant when I noticed that my bootblack in Naples always had a bouquet of flowers in his broken bottle, and that even the street cleaners stopped to admire the painting and sculpture in the store windows. Is it necessary to stifle appreciations like these in order to secure "efficient labor"? I think not. It has been proven beyond doubt that *efficiency depends considerably upon happiness*. And how can any man be happy unless he gets a square deal, occasional encouragement and an opportunity for natural self-expression?

I believe also that such fair treatment will hasten the desire for naturalization. There are still more than 6,000,000 foreign-born who are not citizens. It is interesting that

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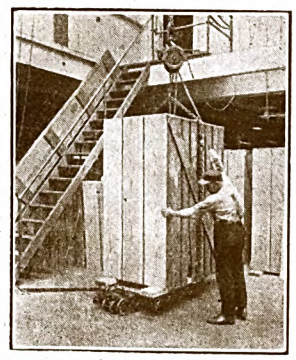
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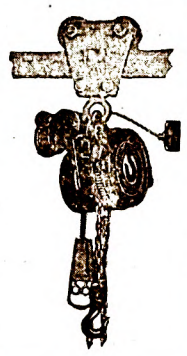
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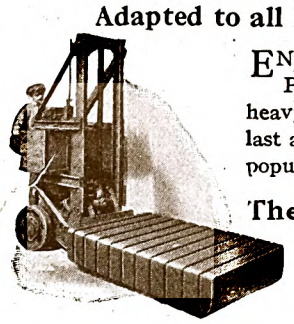


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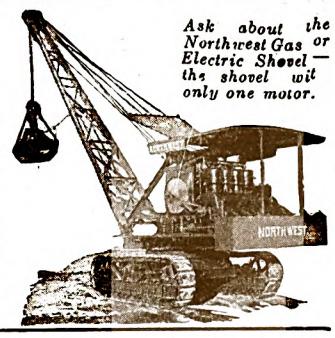
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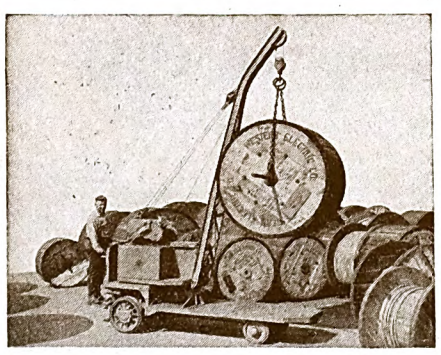
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HANDLING

15.73 per cent of these are Italians; 11.85 per cent Polish; 11.34 per cent British; 11.16 Russian; 6.92 German; 6.68 Canadian; 5.14 Austrian; 3.94 Hungarian; 2.89 Swedish; 2.82 Czecho-Slovakian; 2.12 Greek; 1.86 Jugo-Slavian; 1.76 Norwegian, and 15.79 per cent from other lands. It is easy to blame foreigners for their slowness in becoming citizens, but are we without blame ourselves? A careful study of the situation reveals that the number of our naturalization officials is entirely inadequate, that the clerks are often woefully inefficient, and that our laws are cumbersome and antiquated. It seems as if any person who can prove himself of good character, loyal to America and having resided here a certain number of years should be privileged to take his examination. But not so! We throw up barriers as to color and race, we insist on "the same two witnesses" for two different appearances, we throw down perfectly well-intentioned human beings for a dozen senseless technicalities and then growl at the foreigner for not becoming a citizen!

And the worst of it is—after such experiences as the immigrant passes through—we cannot be assured that he is an *American,* even after he *does* secure his "second papers!"

Il Trentino, an Italian paper, well says:

"If by Americanization we mean the spiritual fusion of all groups and races which have immigrated to America in a common national impulse, a harmonius social expression, the adoption of the country's laws and of its language, the enjoyment of equal rights and of an equal respect, it is well and good. But, if by Americanization we mean the undoing and unlearning of the best characteristic racial traits, the betrayal of the natural affections for the country of origin, the obliteration of its traditions and customs, it is utterly wrong and defeats what should be its real end. Every 'foreigner' who comes to us brings something which can make America a richer and better place. If we wish him to respect us, we must respect him. When mutual respect is established, the task of Americanization becomes an easy thing. Assimilation based on direct or indirect violence upon the language, customs and sentiments of the foreigner, is dangerous to real Americanization. It will make hypocrites, not sincere Americans."

There are over one thousand other foreign language newspapers published in the United States and read by millions of immigrants. Fortunately many of them are printing some very sensible material on this whole subject of Americanization. *Glasnik Istine,* a Croatian paper, indicates that "Merely acquiring final papers does not make one American, unless he means to serve this country as he was willing to serve his original country. The naturalization oath does not mean that the one who takes it shall forget all his past. It means simply that there is only one political allegiance and that this is to the government of the adopted country."

Ameriska Domovina, a Slovene paper of Cleveland, takes a slap at some of its readers thus: "They are wrong who think that because they speak English, wear American clothes and vote at elections they do not need any Americanization. Americanization is something more important and involves far greater duties. The first and greatest duty is to love this country, to love it consciously and profoundly and to be ready to give away one's life for it, for the aims and teachings of the American constitution which is still the model constitution of the whole world."

Paivalehti, a Finish daily, resents compulsory Americanization: "Fanatics and those who do not understand the situation are ready to require that all national endeavors of immigrants be suppressed, their newspapers and the use of their languages, even in the church services prohibited. Such intolerance would not bear good fruit. Through their own national activities the immigrants develop themselves and raise their social status. We do not believe that oppressive measures which have been proposed would be supported by thinking people and those who are acquainted with the situation. Americanization must not be achieved

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through coercive measures in an imperialistic manner but only by education. Every one must be left free to decide whether he wants to become a citizen of this country or to remain a citizen of his native country. Coercion would be contrary to the American spirit and the Constitution which guarantees freedom to every resident, be he citizen or alien."

Rekord Codzienny (Polish) appeals to its readers in these splendid words: "What our brothers demand of the foreign-born who have settled in Poland, is exactly what the sensible and upright American patriot demands of us, and has a right to demand. All the suspicion and ill-will towards the foreign-born in America is due to the fact that a certain number of aliens who come to this country, beyond the necessary labor for their daily bread, take no interest whatever in its institutions and have no desire to familiarize themselves with the country they live in . . . This type of alien is disliked by Americans and is suspected by them, very often unjustly, of disloyalty to this country . . . Not that he should forget his native country altogether—no one has a right to demand that, for devotion to and love for one's native country is a natural virtue instilled in our hearts by the Creator. All that upright and sensible Americans —and these are in the majority—want of us is that we learn the language of the nation of which we are a part, acquire its way of thinking, become familiar with its institutions, take active part in its social and political life and be loyal to their ideals. Such an immigrant is always a desirable and valuable addition and will be respected by Americans. Let us act in America as we would have the foreign born act in Poland."

These significant quotations clearly indicate the possibilities of the foreign language press for good or evil. Contrary to the general belief on the part of many business men and industrial leaders, the great majority of these papers are not radical. If properly cultivated by our industries they can be increasingly used to spread right ideals of industrial justice and Americanization. This is particularly important when one considers the millions who read these publications!

Before the war we averaged 1,000,000 immigrants per year for a decade, but our present restriction laws cut the number down to 357,803 for the fiscal year ending June 30. Inasmuch as each country can send only the equivalent of 3 per cent of its population in the United States in 1910, the effect has been to favor races from Northwestern Europe, which have been judged to be more readily assimilated.

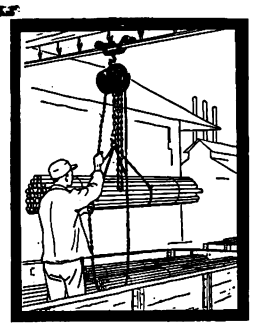
From an industrial viewpoint the most interesting facts are that recent immigration has been largely females and old people and that during the past fiscal year 3,091,556 aliens arrived, but 198,712 left the United States. Furthermore, 32,724 of the new arrivals were designated as "laborers," while 100,058 laborers returned to the Old World—a loss of 67,334. This clearly reveals the major reason for our present labor shortage in many industries. We must face the facts that decreased production, due to lack of unskilled labor, may lead to higher prices and also poorer jobs for workers who ordinarily are capable of more highly skilled labor! Whether Congress will modify present restrictions remains to be seen. "Without unskilled labor," says the New York Board of Trade, "the heart beat of our country's activities will stop." United States Commissioner of Immigration, W. W. Husband, says:

"I am inclined to the opinion that it would be entirely possible to continue the basic number of immigrants at a minimum, and then provide for modifications that would meet the actual needs of the country. We might develop administrative machinery that would serve to invite those actually needed, whether for farming, for industry or for any other activity in the United States."

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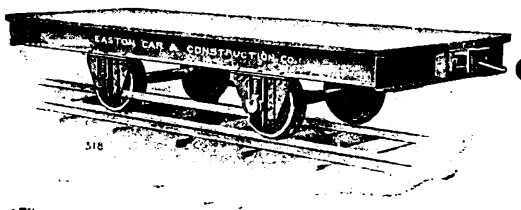
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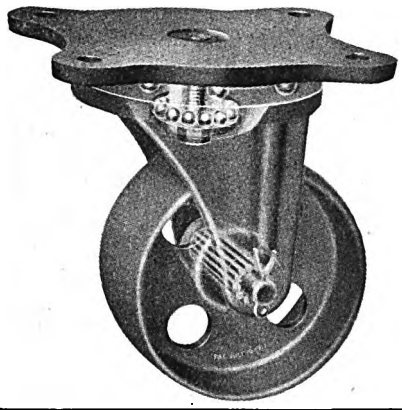
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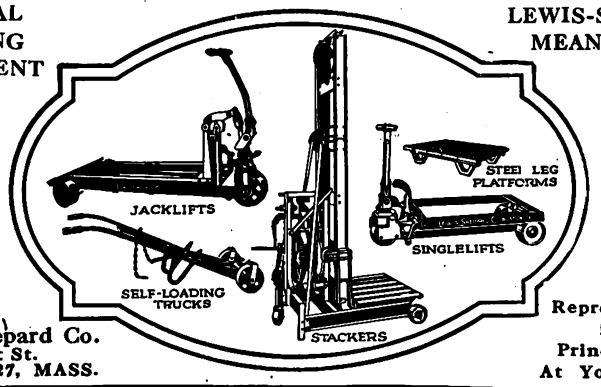
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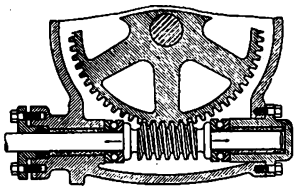
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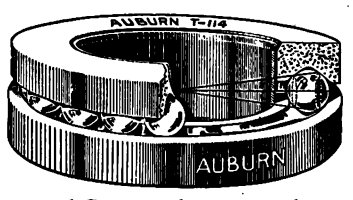


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1880, only 28 per cent of our entire population were engaged in industrial occupations, while today the proportion is over 52 per cent of many nationalities. In 1880 only five states had a major portion of their population in cities, while now this is true of fifteen states. It is well known that the foreigners congregate largely in these cities.

During these same years the number of wage earners has increased 296 per cent and the value of manufactured goods has increased 1180 per cent. This great growth would have been utterly impossible without the foreigner! Let us be fair enough to admit that.

In any consideration of the Americanization problem, we cannot overlook the 22,000,000 people of foreign parentage. Many of these are boys and girls whose criminality is nearly three times as great as that of their parents! This is because they have so frequently been isolated in foreign communities, have left school early and come into contact with a cheap imitation of real American ideals. On the other hand, many have pulled away too rapidly from parental authority, scorned the "wops" and "dagoes" and, in trying to rush into Americanism, have made mighty poor citizens!

Our mines and factories must assume considerable responsibility for this problem inasmuch as they employ so many of foreign parentage. It is amazing that about one-fourth of all the children in the United States of America live in the homes of our foreign-born! We must find a way to give them a new respect for the ideals and heroes of their parents, as well as a more real comprehension of American ideals.

There is considerable encouragement in the fact that while 13.1 per cent of our foregn-born are illiterate, only .8 of one per cent of these second generationists are illiterate, a far better record than that held by children of native parents!

There are over 2,000,000 alien white women over 21 in the United States. The new Cable Act, signed Sept mber 22, 1922, grants independent citizenship to women, and makes it possible for women

married since that date to become naturalized even though their husbands do not. This law puts a corresponding burden upon industry, and our educational and social agencies, for these women must now be educated and prepared for citizenship.

The war thrust large numbers of immigrant women into industry, and many are still there. According to the last census, 40 per cent of the total female population were foreign-born and 60 per cent of bread-earning women were foreign-born!

There are but few in Southern industry except in certain localities—as in the garment industries of Kentucky. Kansas has a number in the meat and poultry packing plants. A large number are in the candy factories of Chicago and Philadelphia, the clothing industry of New York and Baltimore, and in many other industries of our large cities. A surprising number still do "home work," often under unsanitary conditions. In fact, foreign women frequently do the hardest and dirtiest work because of lower standards and because they are obliged to accept almost anything to help expand the family pocketbook.

Altogether the immigrants in America sent back to Europe over $500,000,000 of their earnings last year. But this is small cause for alarm. The sum per capita is less than 4 per cent of the total wealth produced by them. Since it was their own hard earned cash, they had a perfect right to send it away if they desired to do so.

The importance of the proper reception of the foreigner by the employment manager and sympathetic handling by the foremen have already been indicated. A fair deal to the foreigner makes for happiness, stability and efficiency, and inevitably reduces labor turnover. It is not so easy to hold foreign labor as it was before the war. Sensible methods of plant Americanization and assimilation are therefore more vital than ever.

An adequate program of Americanization—in the best meaning of the word—is a legitimate charge against operating expenses. Even if the foreign laborer only remains for a while and then returns to Europe, his employ-

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should see to it that he returns with American ideals and as a booster for American trade and industry. I recently met hundreds of returned emigrants in twenty-three countries of Europe who had gone back with the worst impressions and with the reverse of these ideals.

Plant Americanization Committees, composed of different nationalities, help distribute the responsibility of giving every opportunity for the learning of English and Citizenship. Classes may be held at noon hour, just after hours, in the evening or on Company time. Many companies give rewards or promotion to those who attend faithfully and "pass" successfully. Foreign leaders of intelligence and ability can be of great help. One manufacturer recently said, "These Italians are fine chaps. We have no trouble with them, they are good workers, and appreciate everything we do for them." Another in the same city remarked, "That company has a better bunch than we have. Our Italians are no good!" Investigation revealed that it was not the Italians but his method—or rather lack of method—of Americanization which was no good.

Many plants find that it pays in every way to give free legal advice, which often results in rescuing foreign employes from loan sharks and others who prey upon them. Thrift campaigns, lectures on various subjects, social gatherings of foreign and native born, picnics, first-aid and safety promotion, athletic leagues, community clean-up campaigns, clubs for foreign boys, classes in home economics for women are all tremendously worthwhile.

Special emphasis should be given to those types of activity which develop self-expression. The celebration of foreign as well as American holidays, pageants, folk dances, mass singing of national songs, dramas by foreign playwrights, exhibits of native costumes or handiwork are a joy to the foreigner and an education to the American!

Said a superintendent recently, "These plant sings have knit our whole plant together. And even the foreigners now call the officials by their proper names instead or just 'the boss.'" A singing man seldom grows weary; thus music may help increase shop efficiency.

If industrial executives and shop officials were to look at this problem only from the selfish viewpoint, they would agree that it pays to spend time, energy and money on a thoroughly worthy program of Americanization. After all it is a great coöperative undertaking in real democracy and internationalism, and what two things could be more important in the present stage of the world's history?

For photographs in this issue, not otherwise credited, we are indebted to the courtesy of the following:

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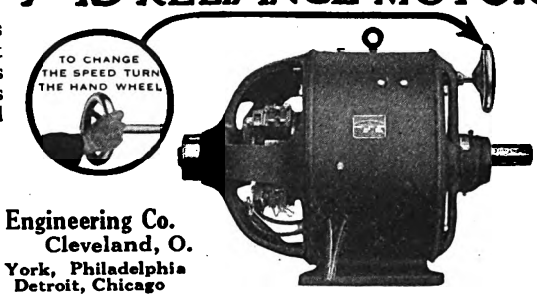
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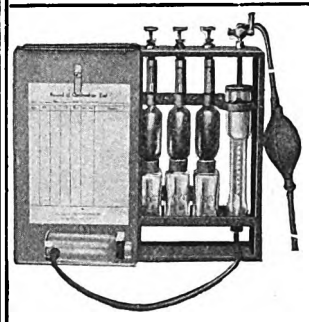
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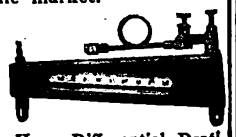
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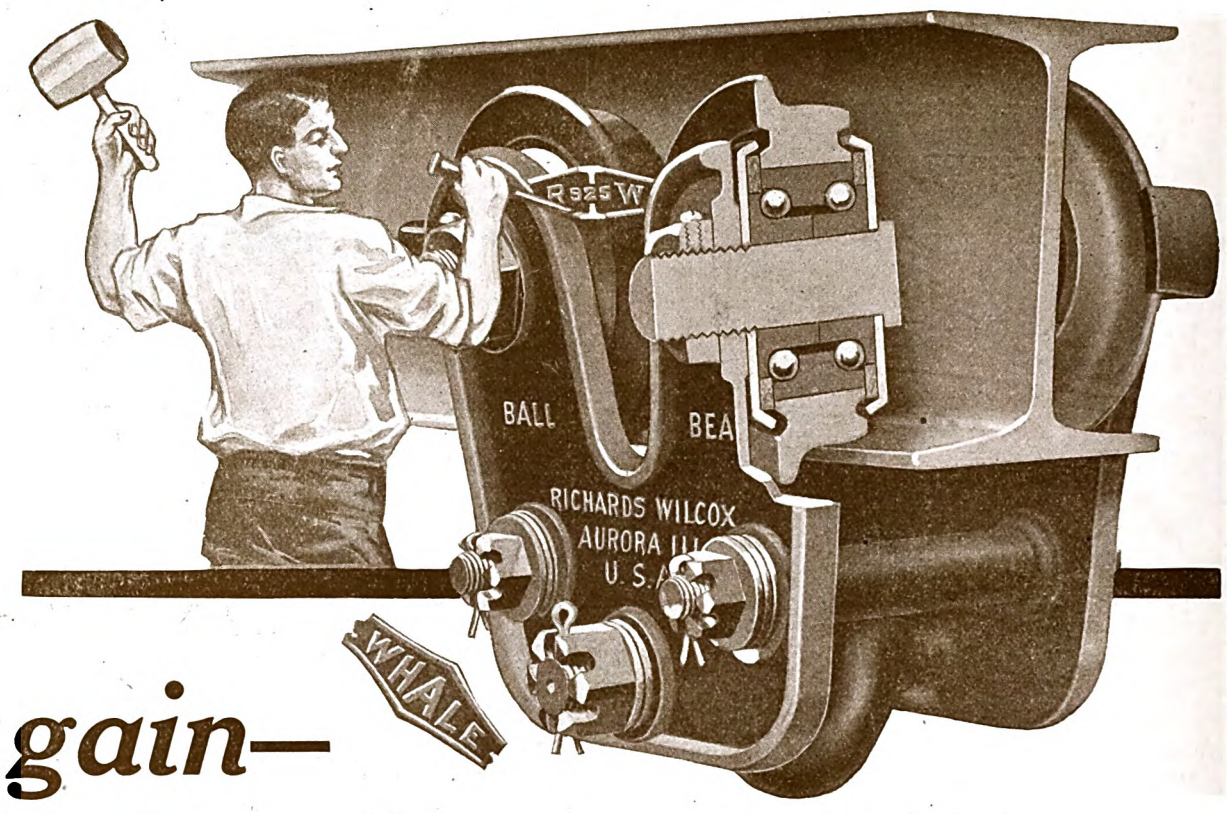
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EQUIPMENT

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Richards-Wilcox

Quality leaves its imprint



Again— Quality leaves its imprint

As a result of our contest for a new name for our ball-bearing I-beam trolley, 2,152 suggestions were received. The majority of contestants submitted names involving the use of the letters R-W, such as SupeR-Way, WondeR-Worker, etc., while four suggested that we use merely the letters themselves.

This convinced us that no better name than "R-W" could possibly be chosen, constituting as it does a universally recognized guarantee of quality and dependability. Therefore the following contestants, all of whom submitted the name "R-W," have each been awarded a $50.00 prize:

MR. CHARLES T. ALLEN
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MR. FRANK HEIN
of Hein Implement Company, Ladysmith, Wis.

MR. R. S. CHENEY
of Railway Purchases and Stores, Chicago

MR. C. E. DAVISON
of Harper and Reynolds, Los Angeles, Cal.

5 Exclusive Features

1 Because of its short wheelbase, the "R-W" operates almost as easily on curves as on a straight-away.

2 Felt washers prevent gritty dust and dirt from reaching the bearings. They also absorb oil from the oil hole and transmit it to the bearings continuously.

3 Bumpers protect all four wheels from chipping when trolleys bump together or strike the stop at the end of the track.

4 Combination radial and thrust bearings are found only in the "R-W." The ball races are ground and the balls themselves are of high-duty steel. This feature enables a one-ton load to be started by the pull of a man's little finger.

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R 925 W

Ball-Bearing I-Beam Trolley

Every person who is familiar with R-W products knows that "R-W" and quality are synonymous. This is particularly true of overhead conveying equipment—a field in which "R-W" has long been accepted as a pledge of lasting satisfaction.

The "R-W" ball-bearing I-beam trolley (formerly the "Whale") is the outcome of a sincere desire to overcome *every* fault common to I-beam trolleys. Rigid tests over a long period of time have demonstrated that the "R-W" is the most durable, most efficient and most easily operated trolley ever produced.

Sent for Free Trial We are so confident of the ability of the "R-W" trolley to meet the most exacting requirements that we are willing to send it to any reputable manufacturer for free trial. Such a trial involves no obligation, for if the trolley fails to come up to your expectations it may be returned at our expense. The "R-W" trolley is made in seven capacities, ranging from ½ ton to 4 tons. Send today for the size best suited to your needs, or ask for Catalog DD-23.

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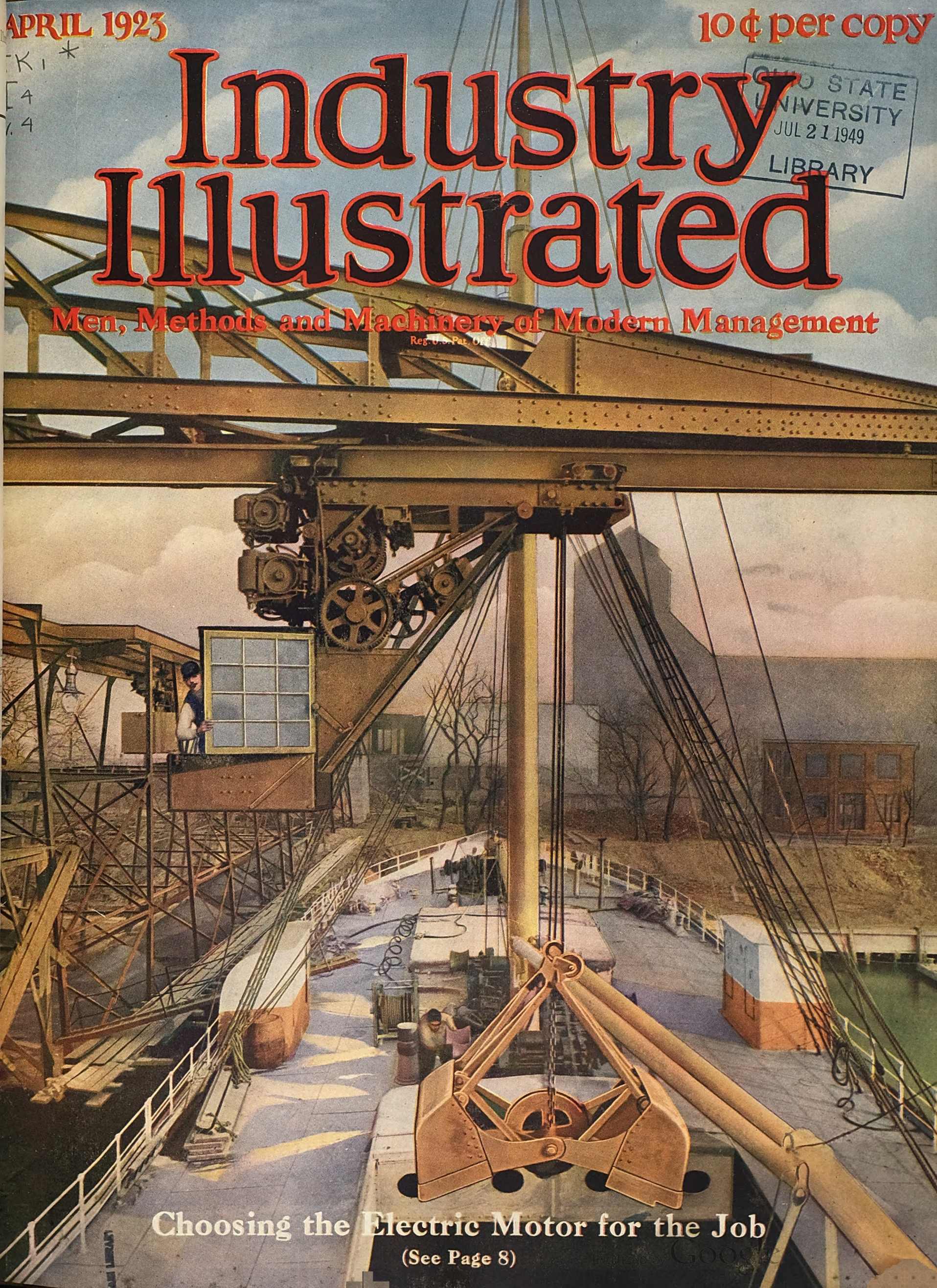
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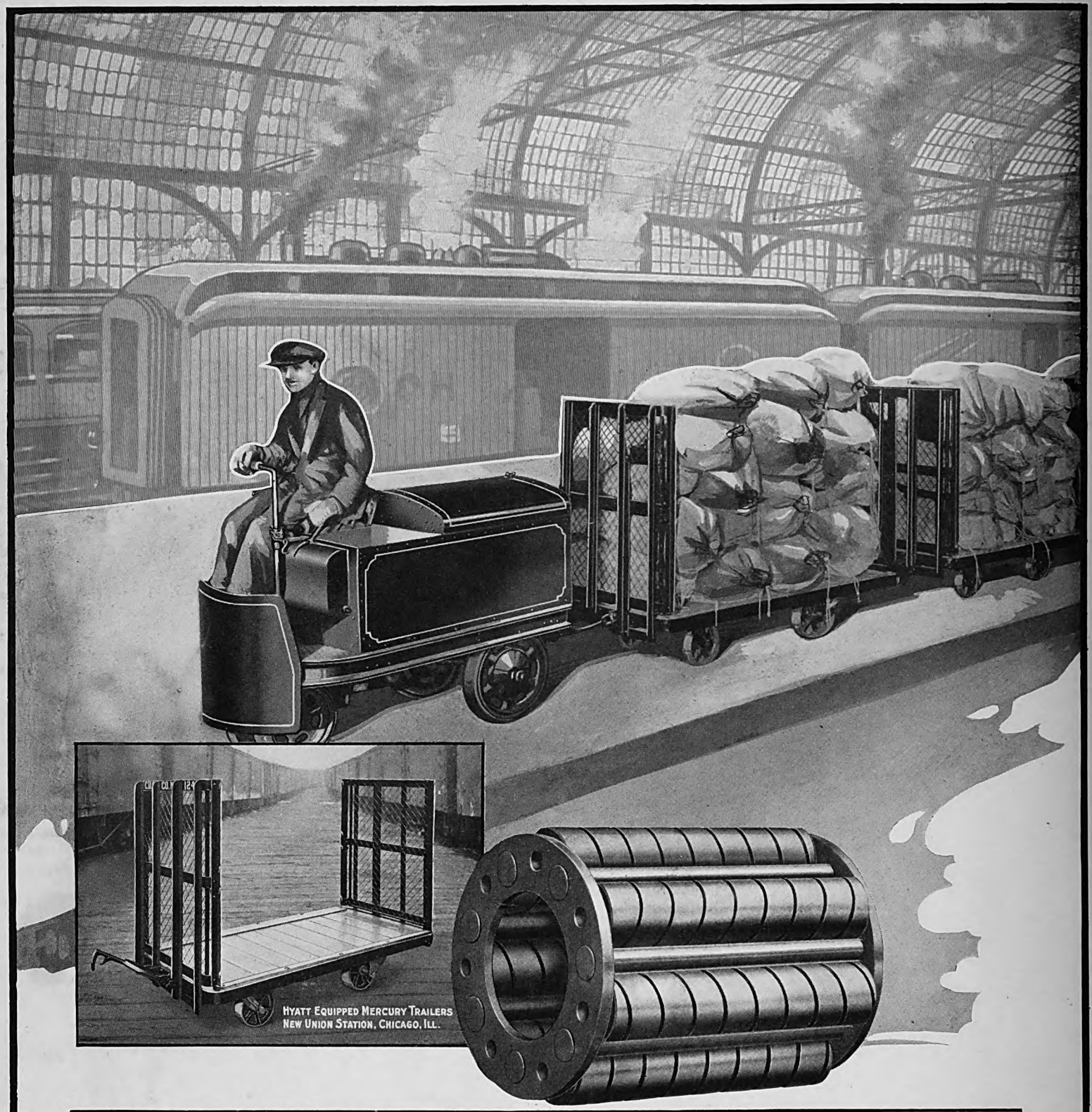
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Choosing the Electric Motor for the Job

(See Page 8)

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MORE POUNDS PER TRAILER – MORE TRAILERS PER TRACTOR

Two hundred Hyatt equipped Mercury trailers are now being used to haul parcel post mail between the new Chicago Parcel Post Terminal and the new Union Station in Chicago.

The easy running Hyatt bearings make possible more pounds per trailer and more trailers per tractor, and they will give years of economical and successful service without adjustment or replacement.

Specify that your trailers be Hyatt bearing equipped and reduce your haulage costs.

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Industry Illustrated

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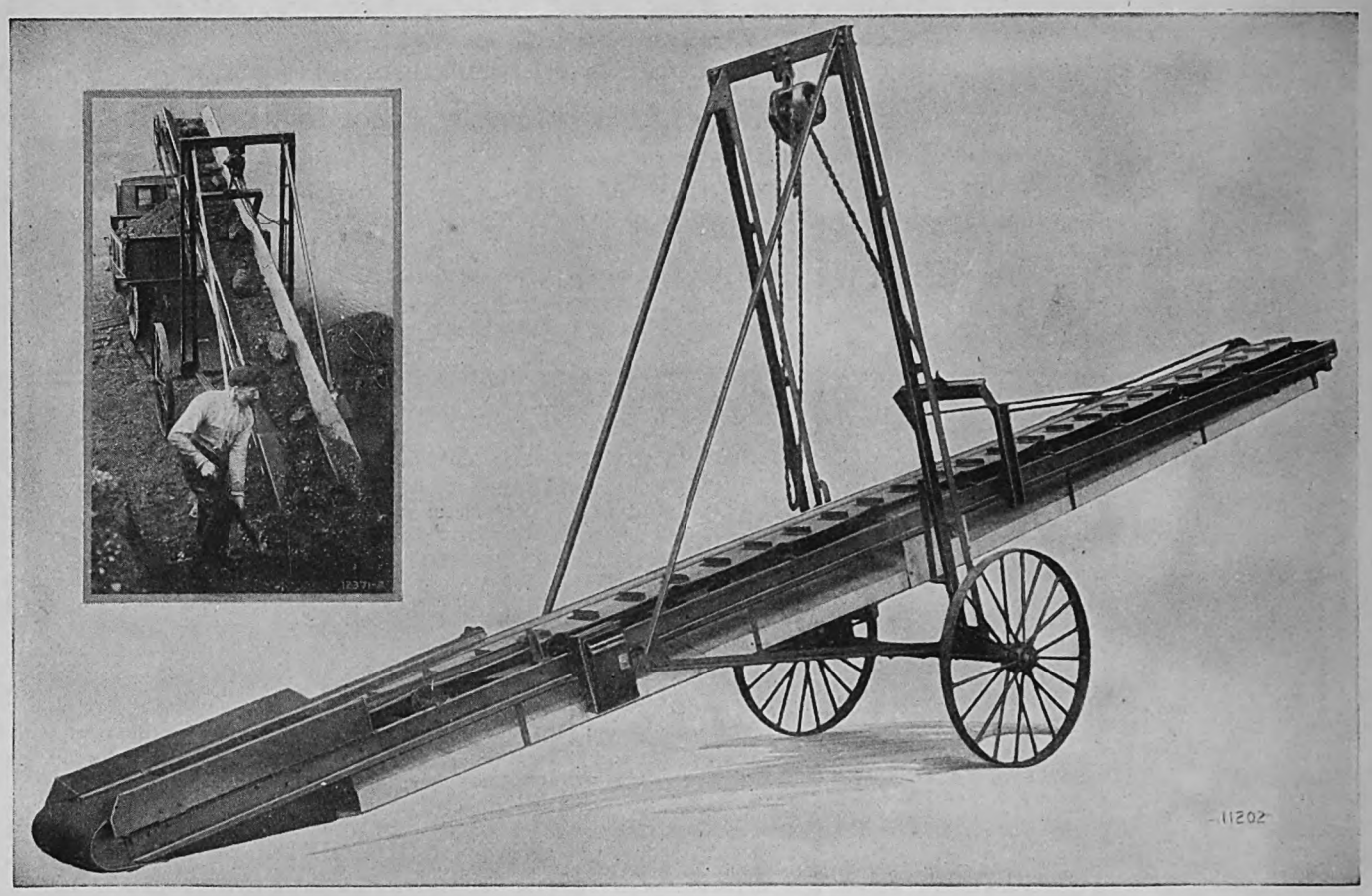
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Length of conveyor, 21 ft.
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Increased production, due to our large volume of sales, has made this low price possible.

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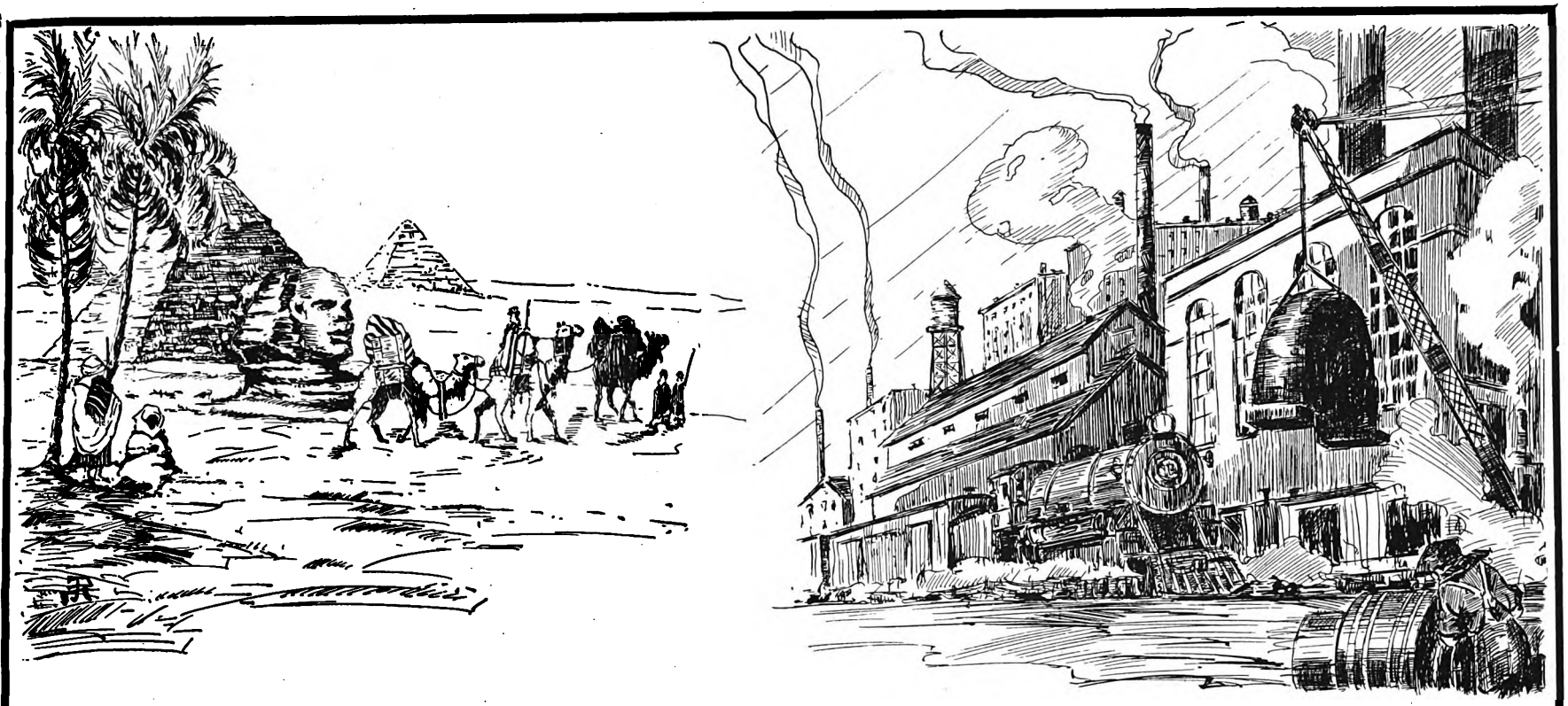
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He would have 3400 years of personal experience, which he could capitalize. He would have, for example, a definite knowledge of industrial methods used in building the pyramids and Noah's Ark. He could tell of methods used by Tubal Cain in the iron industry and how they have been changed and developed up to the present time.

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The average man who is engaged in industrial work is depending very largely upon his personal experience to gain the necessary knowledge to fit him for executive work in industry. BUT he cannot make rapid progress in that way and he doesn't live long enough to cover any appreciable part of the field.

Industrial organizations everywhere are on the lookout for men who can manage production. They want such men ***now.*** They cannot wait until they have had 30 or 40 years of personal experience.

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THE HYTOR COMPRESSOR is valveless, has no gears, loose moving or reciprocating parts, no piston packing to renew, no cylinders to lubricate and no bearing adjustments to make.

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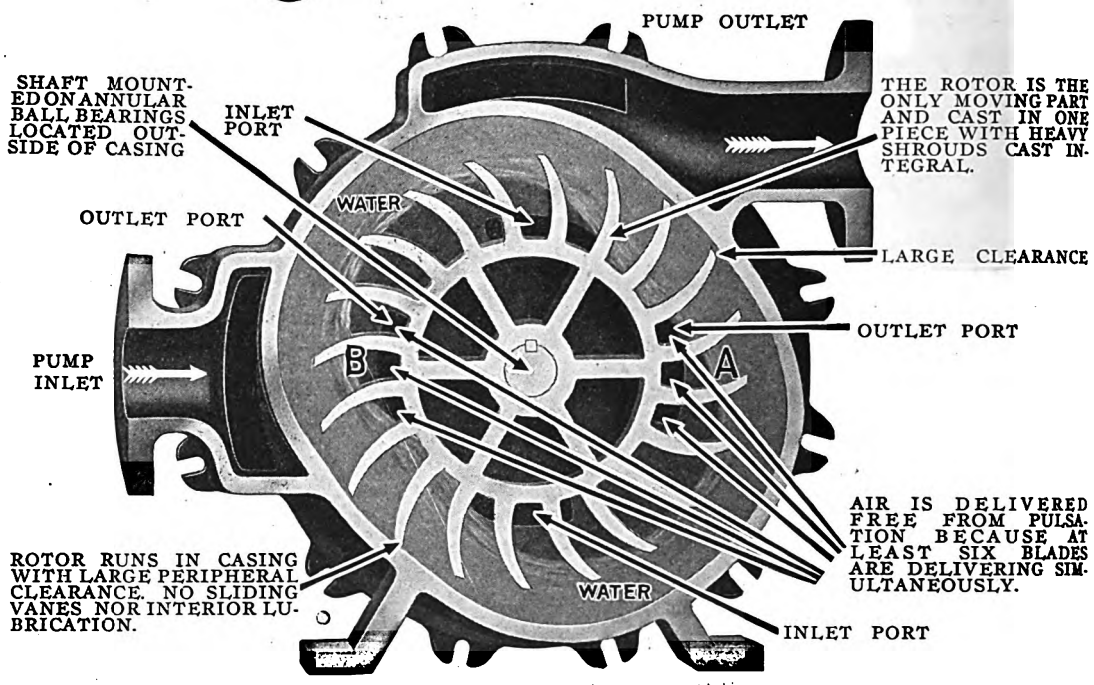
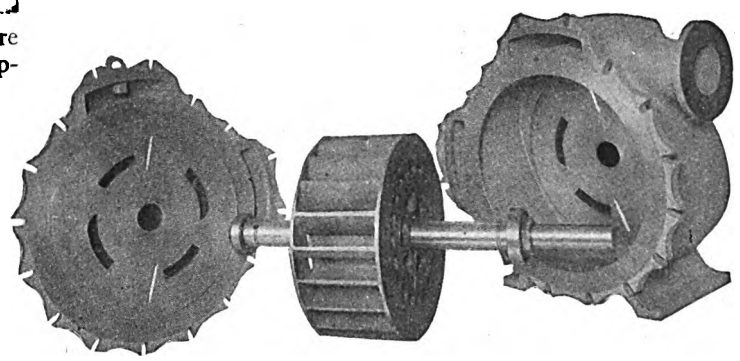
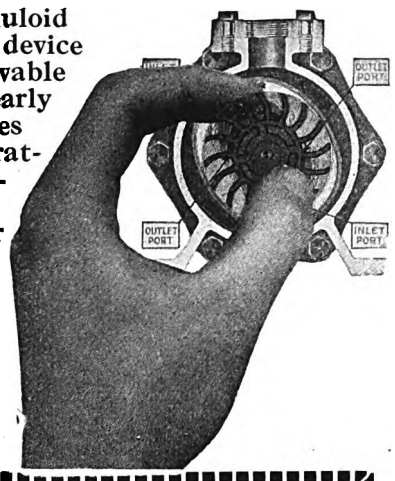


Diagram illustrating unique principle of operation



A ROTOR in hydraulic balance revolves freely in an elliptical casing filled with water. The water, turning, with the rotor, and constrained to follow the casing by centrifugal force, alternately recedes from and is forced back into the rotor, twice in a revolution. As the water recedes from the rotor it draws in the air through the inlet ports. When the water is forced back into the rotor by the converging casing, the air is first compressed and then discharged through the outlet ports.

This celluloid graphic device with movable rotor clearly illustrates the operating principle. Send for your copy.

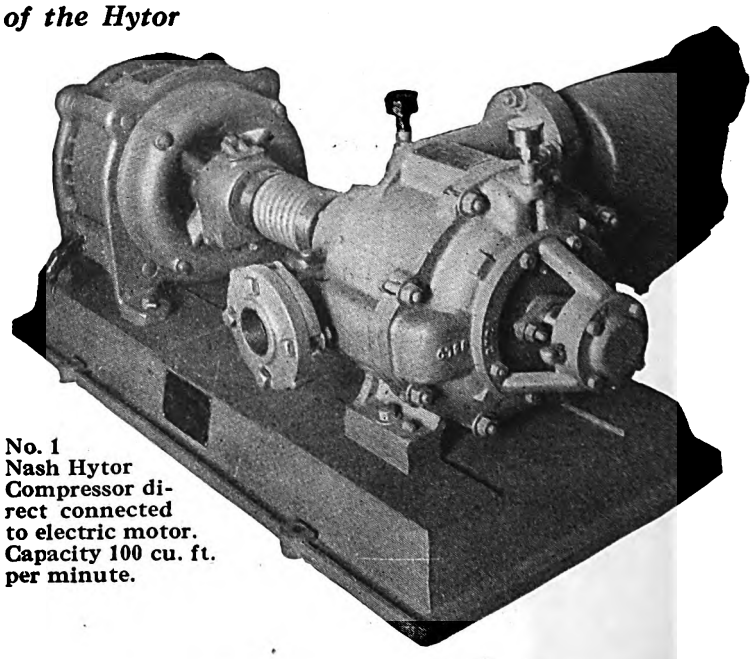


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At pressures up to and including 15 lbs. per square inch, and vacuums up to 20 inches of mercury, the Nash Hytor affords the simplest and most economical means for handling air or gas, for all of the usual purposes where air under pressure is required, and they can be used on many special services for which the ordinary compressor is not adapted.

It is common practice in handling mildly acid vapors to re-circulate thru the pump an alkaline solution for the protection of the cast iron structure of the pump. In handling chlorine gas, concentrated sulphuric acid is re-circulated.

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No. 1 Nash Hytor Compressor direct connected to electric motor. Capacity 100 cu. ft. per minute.

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EDITORIAL

The Limitations Of Work

THERE is a limit to everything that is finite. In most instances, that limit is close by; in others, it is farther away; but, in all instances, it can be defined. There are limits to speed, pressure, resistance, strength of materials and the like.

It is engineering practice to ascertain whether a limit is close by or far away; to find out how close it is or how far away, for all kinds of engineering projects. Before beginning construction work, the engineer must know what the limits are to the strength of the materials that are to be used. He cannot afford to assume anything in this regard and makes elaborate tests to determine how much strain the materials he expects to use can withstand safely. He encounters other limitations such as those of time in which to do the work, available funds, and ability to secure competent workmen. His work is limited in all respects.

An engineer does not attempt to utilize every last vestige of strength that a material of construction may possess. He tries to ascertain what strength that material has so as to know how to play safe. After he finds out what the amount of strength is, he utilizes only a reasonable proportion of this strength and depends upon the overplus to take care of miscalculations, emergencies and overloads. This overplus represents the factor of safety and it is always made large in construction work. If an engineer should be foolish enough to utilize all the strength he believed the materials to have, his structure would collapse at the slightest change in existing conditions.

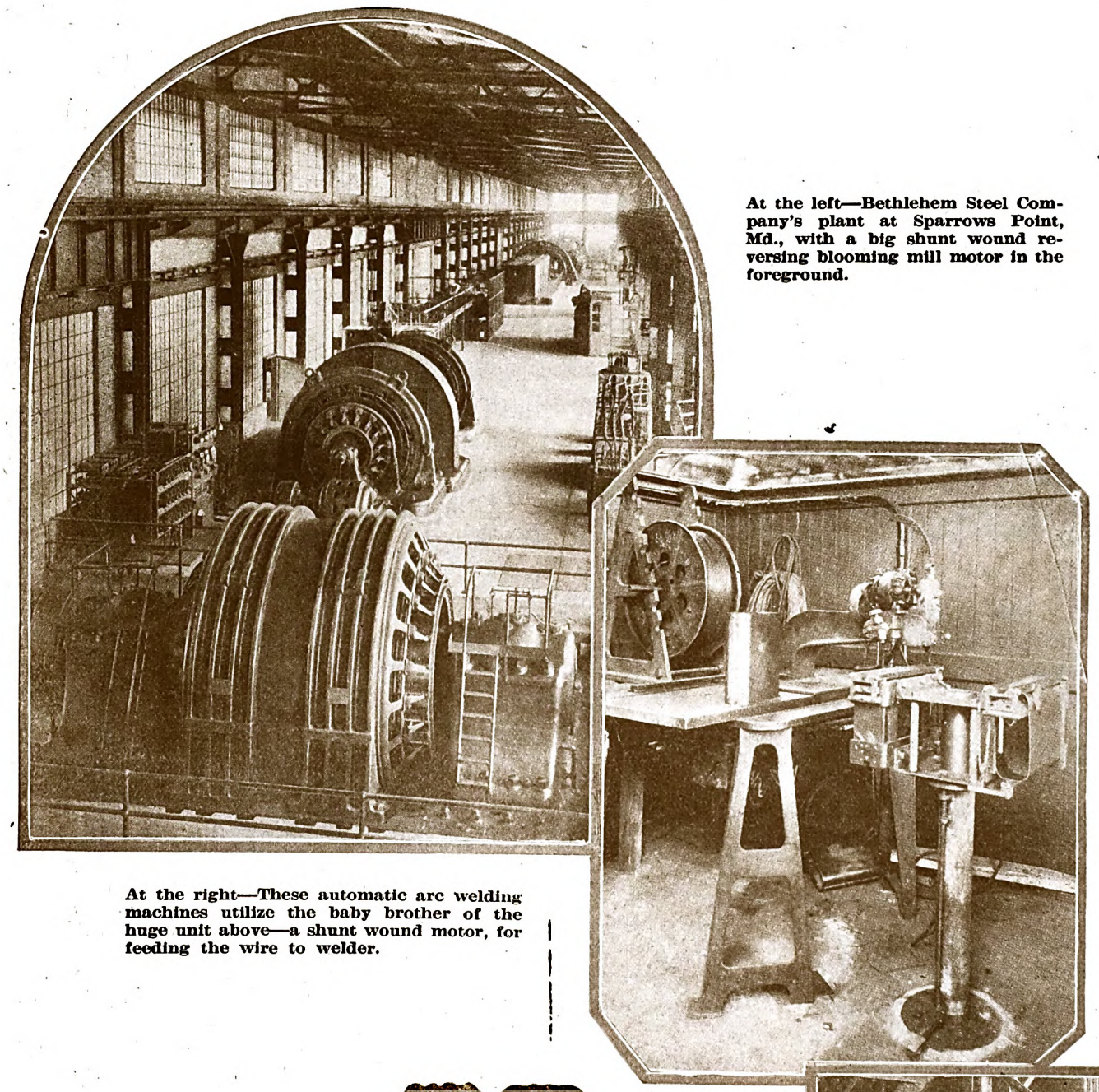
Not only is the kind of work a man can do limited because of the limitations to his ability, but the amount of work he can do is limited because of the limitations of his human endurance. These limits are variables, they are elastic limits, but there is only a certain amount of work capacity in any man and there is only a certain amount of work in a workman. When all the work there is in a workman has been gotten out of him, that workman is dead.

There is a limit to the amount of work a workman can do safely; that is, with safety to industry. The evolution of a good workman is a slow, expensive process. Industry cannot afford to attempt to utilize too great a proportion of the strength or endurance of its workmen. They must be afforded at least as much margin of safety as is given the materials of construction, or the danger of their collapse becomes apparent.

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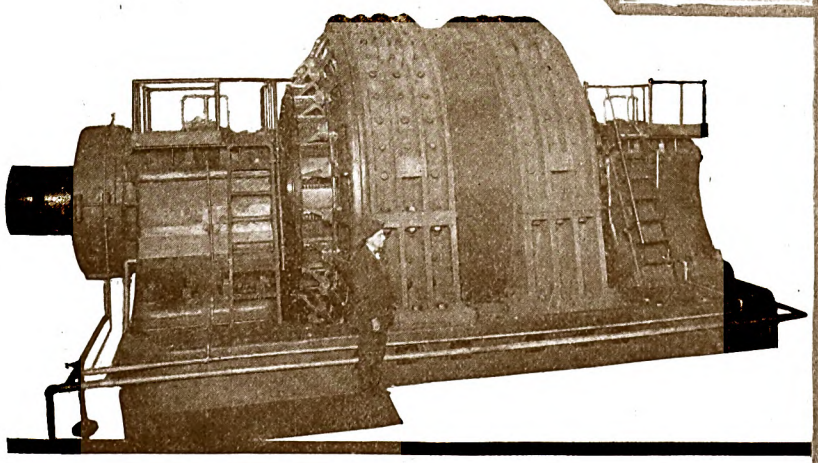
Choosing the Electric Motor for the Job

By A. K. West

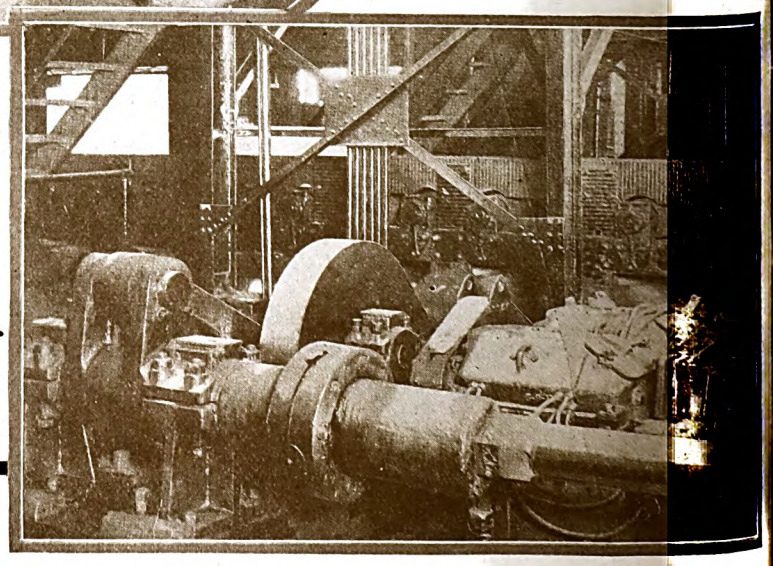


At the left—Bethlehem Steel Company's plant at Sparrows Point, Md., with a big shunt wound reversing blooming mill motor in the foreground.

At the right—These automatic arc welding machines utilize the baby brother of the huge unit above—a shunt wound motor, for feeding the wire to welder.



This unit is similar to the one shown at the top of this page. It is a 7000 hp. reversing motor for blooming mill drive.



The "Manipulator kick-up fingers" on this blooming mill of the Trumbull Steel Co. are operated by two series-wound motors.

THE part played by the electric motor in developing our present industrial era has undoubtedly been enormous. In fact, the electric idea is so firmly established that the question, "Shall electric motors be used?" has been superseded by, "What sort of motor will do the work best?" It is no exaggeration to say that the proper answer to this question has a decided effect upon the operating expenses and general efficiency of industrial plants. Electric motors have pronounced characteristics that fit or unfit them for certain classes of work; and even a superficial knowledge of these is of much value in applying the motor to the job in hand.

Electric motors are divided into two general classes, direct current and alternating current. They are further subdivided, the direct current into shunt, compound, and series motors; the alternating current into induction, synchronous and series, or commutating. These terms refer to the method of connecting the motor, or to some particular characteristic of its operation.

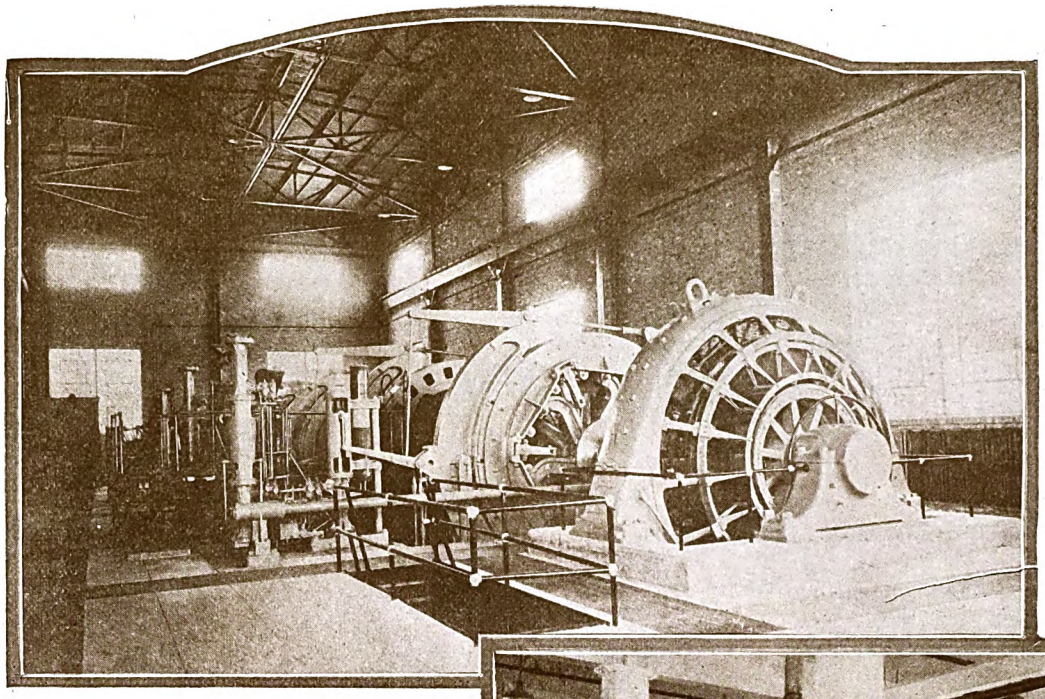
The characteristics of the shunt motor give it, industrially, the greatest field of any of the three direct current motors. Its field, upon the strength of which its speed and

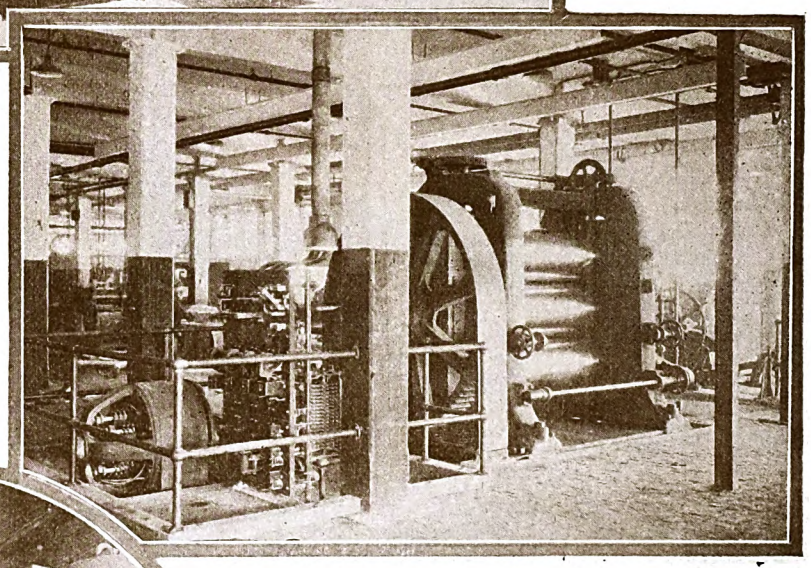
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The speed of the series-wound motor, varying with the load makes it particularly useful for hoists.

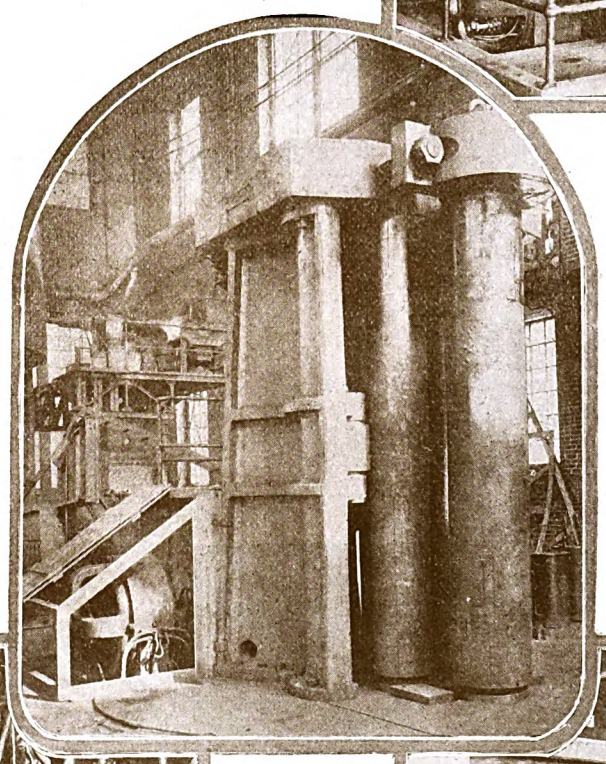
orque depend, is "shunted" r connected across its armture and the power supply. he speed is practically constant for all reasonable variations in load, its torque is not ffected by its speed and is herefore good during starting nd accelerating periods, and s efficiency is high over a ide range of load. Its speed readily controlled, variations eing made by changing the mount of resistance in the eld, the speed of the motor eing inversely proportional to e strength of the field, within rtain limits. The shunt motor is applicable to a wide variety of uses; for example, driving line shafts, blowers, ciprocating pumps and machine tools. Most of these pplications call for constant eed over long periods of me, and good efficiency under rying load conditions. A table example of shunt motor application, notable both om the size of the motors and e severity of the working nditions under which they erate, is that of driving reersible rolling mills in steel ants.

The largest motors used in is work are rated at 8000 HP ntinuous with a momentary pacity of 17000 HP. An ea of their size can be thered from the fact that the

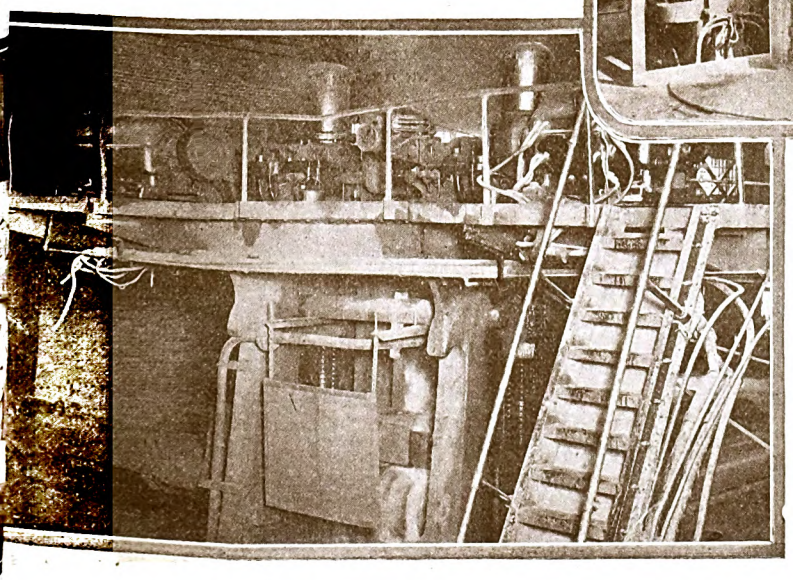




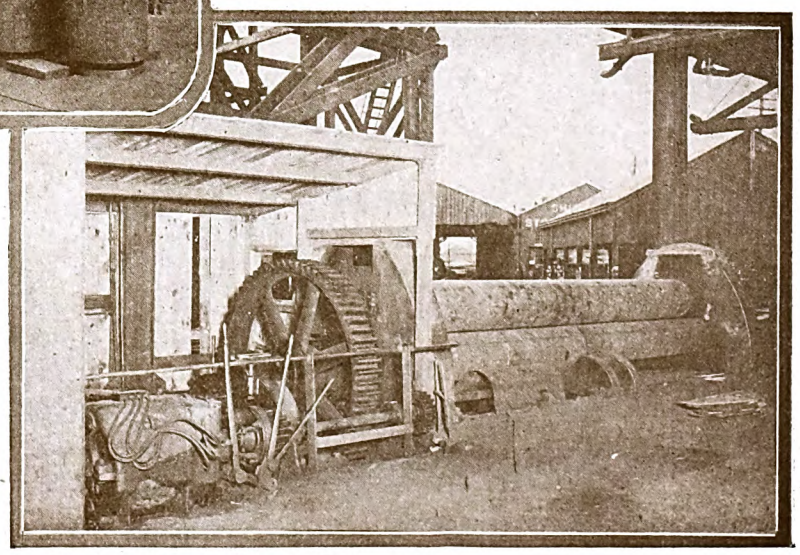
Calendar rolls at the New England Tire & Rubber Co., driven by 100 hp. D. C. motor with semi-automatic control.



At the left—Bethlehem Steel Company's vertical rolls, driven by a compound-wound motor.



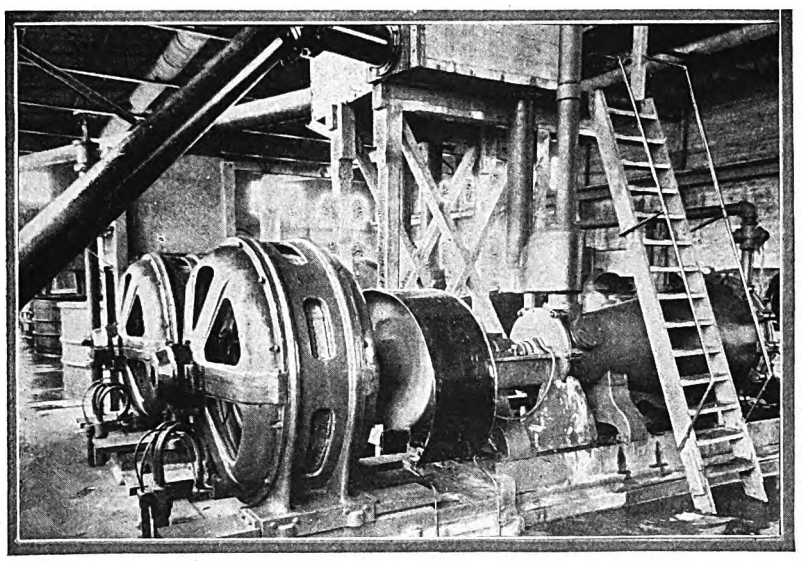
Here is the "screw down" on a blooming mill, operated by two compound-wound motors.



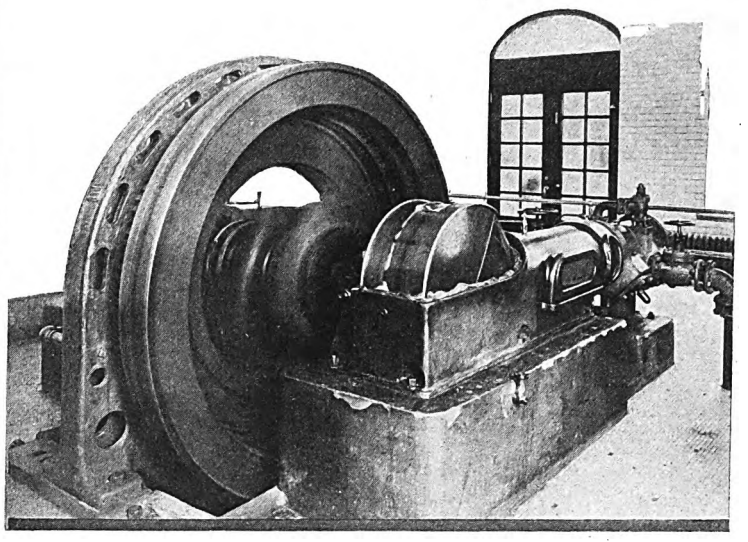
Bending rolls equipped with compound-wound motor—Harlan & Hollingsworth Corp.

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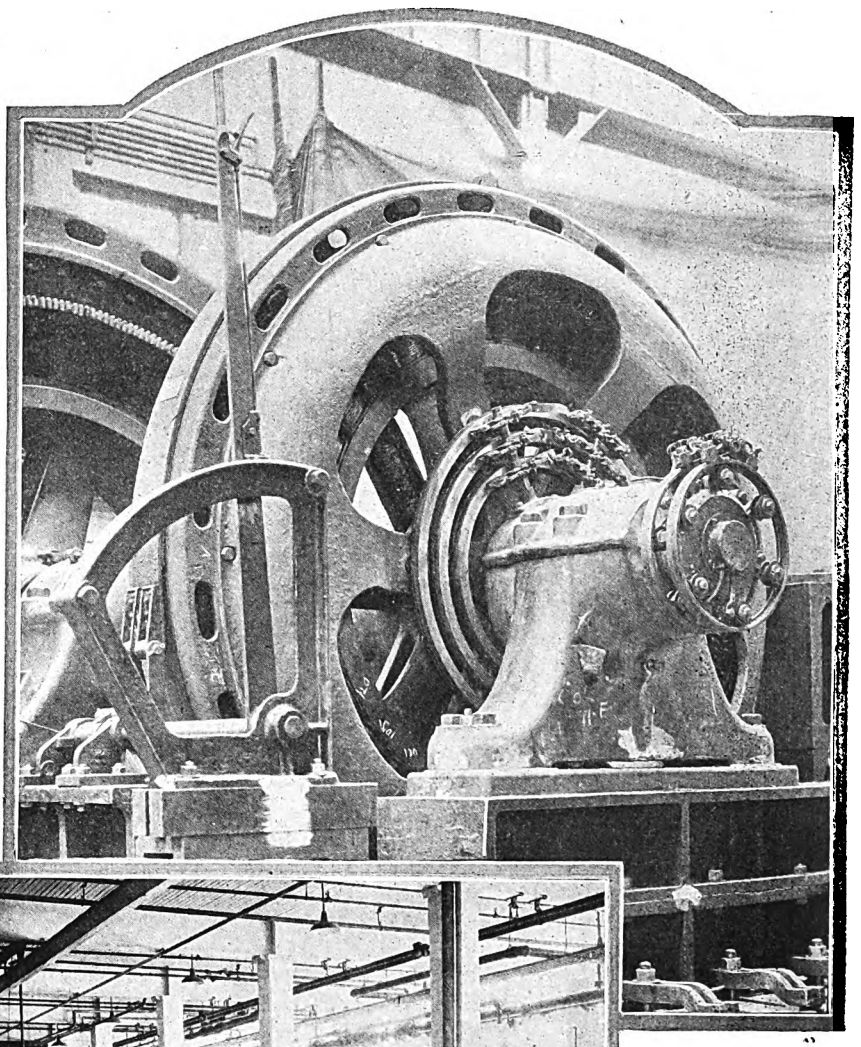
Two 200 hp. synchronous motors at the Hoskin-Morainville Paper Company's plant at Menominee, Mich.



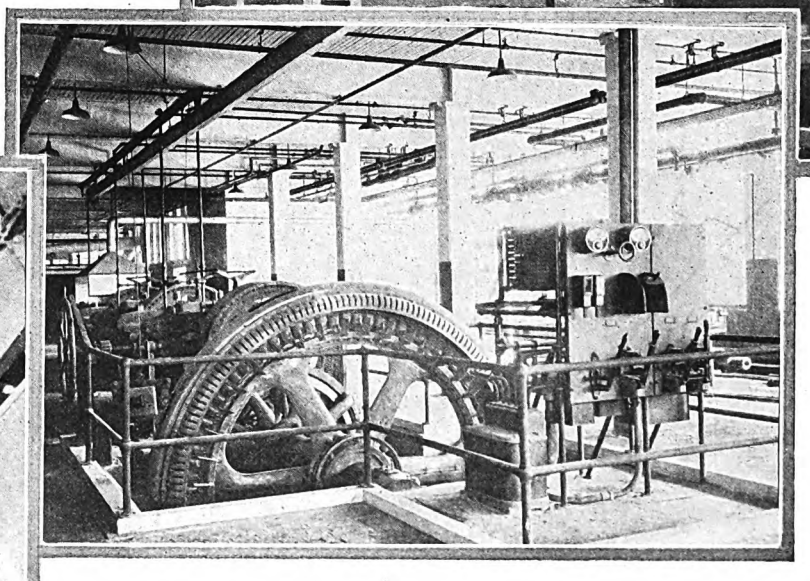
Ammonia compressor at the Colonial Ice Cream Co., Philadelphia, driven by 300 hp. synchronous motor.

this motor, the field is connected in series with the armature and the line so that its speed varies with changes in load, being directly proportional to the amount of the load. The efficiency is high throughout a wide range of speed, and the torque at low speed, or under heavy overload, is high. A limitation in the usefulness of these motors is that at no load the speed becomes so high as to be dangerous. Therefore they are always connected rigidly to the load, being very seldom used for belt drive, for instance, where they are liable to be unloaded through the breaking or slipping of the belt. Their particular field of application is for cases where high starting torque is required, and the matter of changing speed is negligible. Consequently they are largely used on electric railways, for hoists, cranes, and other machinery that must

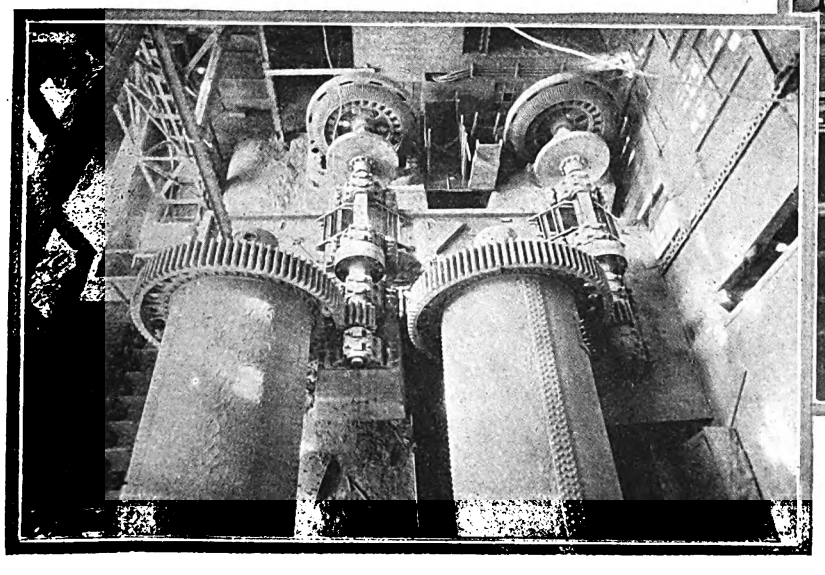
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At the right—a 450 hp. synchronous motor with revolving stator.



Looking down on two 500 hp. synchronous motors driving tube mills at the Western States Portland Cement Company's plant.



Above—A 250 hp. synchronous motor which drives three 60" mills at the New England Tire & Rubber Company, Holyoke, Mass.

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Handling Materials in a Book Bindery

The Economies Effected by Planned Layout and Mechanical Handling

BY E. W. PALMER

A GLANCE into any bindery would convince the most versatile industrial engineer that the paramount problem in bookbinding, from an efficiency standpoint, lies in eliminating rehandling of materials and work in process. To accomplish this usually means the rearrangement of machine groups, installation of added transportation facilities, and acquiring added floor space.

In our own plant the problem was quite the same but we reversed the processes. First we leased new quarters, where we could obtain 65,000 square feet of space on a floor, thus enabling us to handle the binding of a book from the receiving of the flat printed sheets from the press room to the delivery of the completed volume, all on one manufacturing floor. When one considers that the average novel or school book in its progress through the bindery, in the successive stages of folding the flat printed sheets into "signatures" (or sections of 16, 32, or 64 pages), pasting in the illustrations (inserts), gathering the sections together, sewing, smashing, trimming, gilding edges, rounding and shaping the back, reinforcing the book to hold it in the cover and finally placing the book in the cover, pressing and drying before examination, wrapping and shipping; not to mention the cutting of material for and making and stamping the covers themselves; no less than 63 separate operations are involved, this one floor plan includes a very careful floor layout.



A view of the Sheet Room, with the Machine Sewing Division in the foreground. Note the individual machines, each a moveable unit, the cord and plug connectors; the worked material handled to and from the machines on platforms by means of lift trucks.

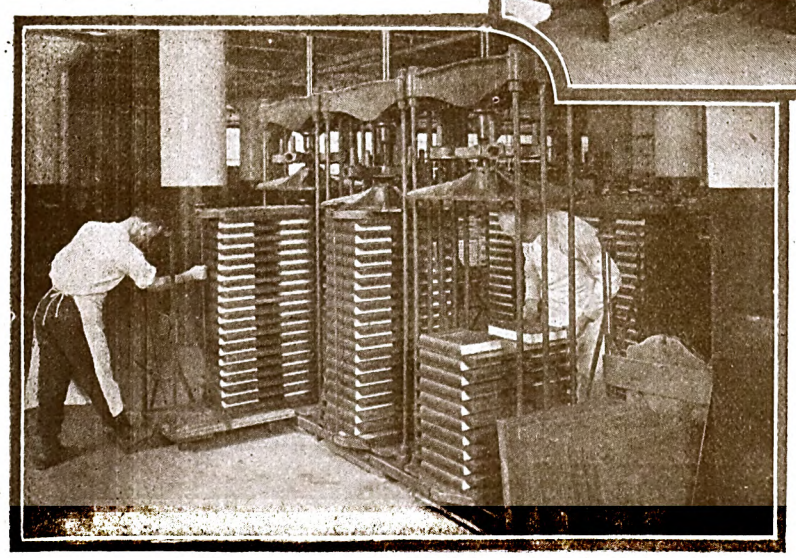
Another view of the Sheet Room, Pasting and Gathering Division, showing the manner in which work ahead for machines may be placed ready for use where machine is finishing previous lot. Note again individual cord and plug connections to each machine and maple top tables with standard iron pipe legs.



With a very scientific layout, whereby work progresses through the various stages of manufacture without retracing a step, much is accomplished. This requires "assembling" points at or near the machine and hand working groups and machines grouped to facilitate bulk production.

In order to make our plant "flexible" we ran all wiring in conduits on the ceiling, with plug receptacles placed systematically, so many to each bay. All machines of a movable type are mounted on polished maple bases with individual motor, control apparatus and pilot light. Power is obtained through standard cord connectors having plugs at both ends. This permits moving machines at will, regrouping, replacing, etc., and does not deface building nor present power difficulties.

All machines are equipped with individual motors, thus eliminating all lost time possibilities so prevalent where single unit, shaft and belt

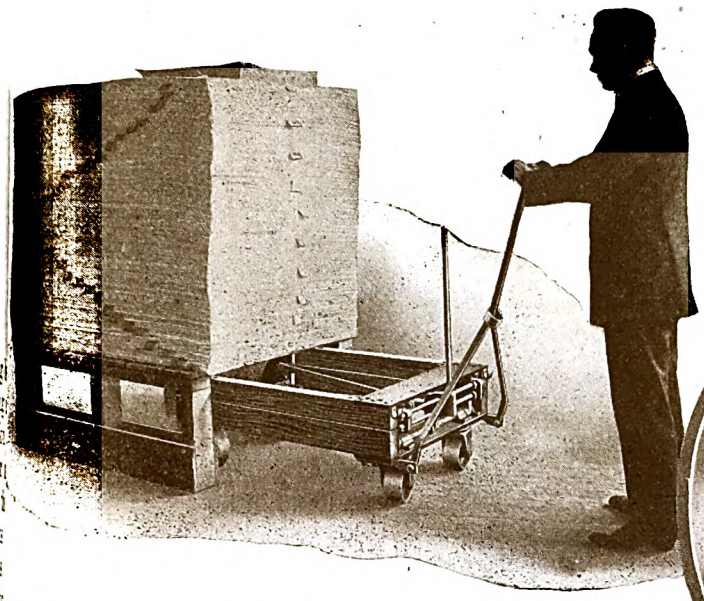


Building books, by means of Removable Equipment into press, and method of removing loaded press.

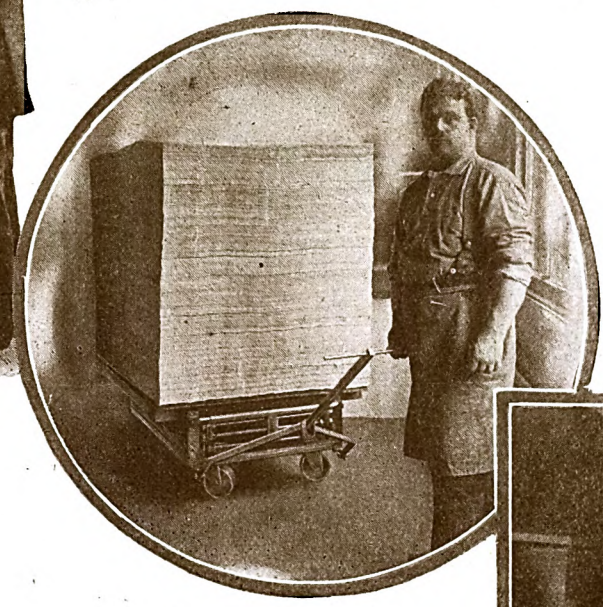


Removing finished and dried books from moveable press direct to examiner's table.

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This plant is more than ordinarily aware of the advantages of the lift truck, for the reason that the germ of the whole platform lift-truck idea had its inception in the mind of its former plant engineer.



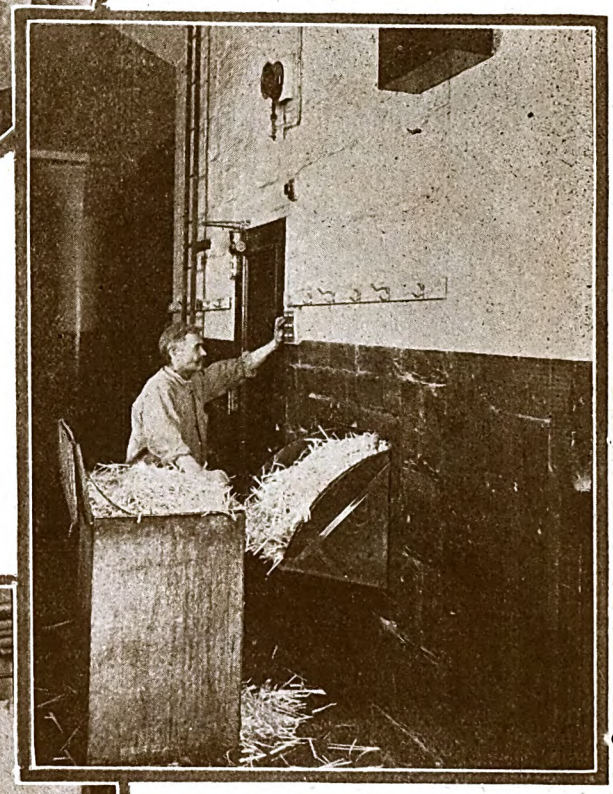
The lift truck platform is used not only for materials in transit, but also for storing sheets or books in unit quantities so that they may be readily moved when called for.

drives are used. Repairs are made on these machines in the machine shop, not on the working floor.

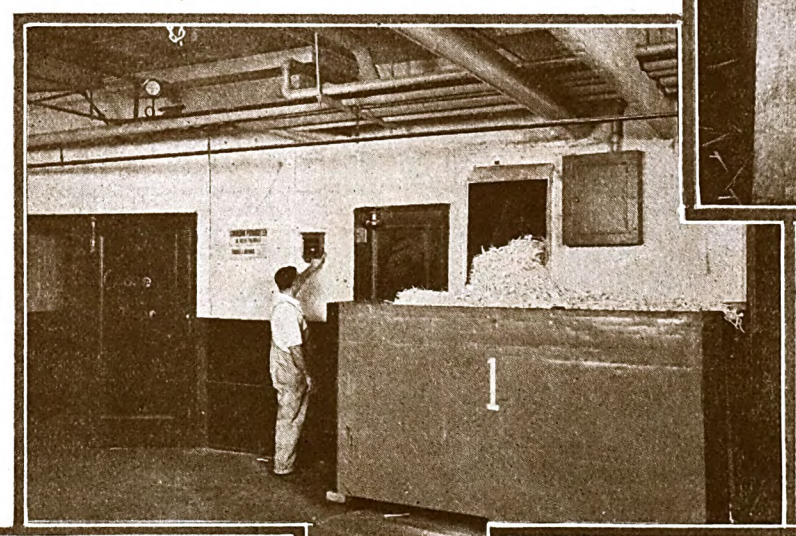
Glue pots, finishers' tools, pressing irons, food heating slabs and machines requiring heat are equipped with electric heater units of interchangeable type. Replacements and repairs are quite simple.

Many little economies possible in all industries are overlooked because they are so obvious. Take for example pressing books after they are placed in the covers. It is necessary to press and dry books for from six to twenty-four hours, depending upon the character of the binding. Upright iron presses have always been used for this purpose—we had dozens of them. Suddenly, we came to a realization that after the pressure was once applied in the press, all that was needed was a medium for keeping the pressure uniform; so we evolved a

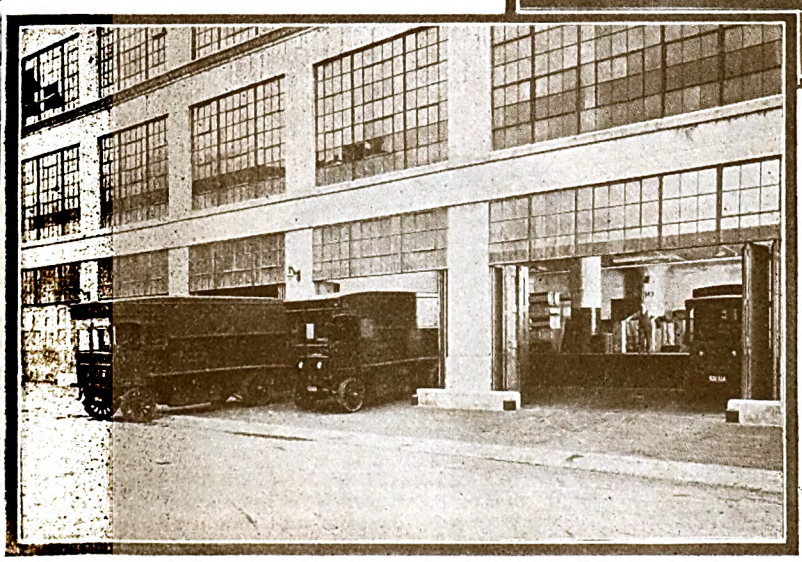
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Accumulating the waste. Chute delivering selected waste into numbered bin trucks for baling. Note the indicator telling quality of waste.



Saving the waste, workman sending selected paper shavings from cutters to baling room in basement. Note the annunciator system for signalling the quality of waste.



Truck garaging, charging, loading and unloading.



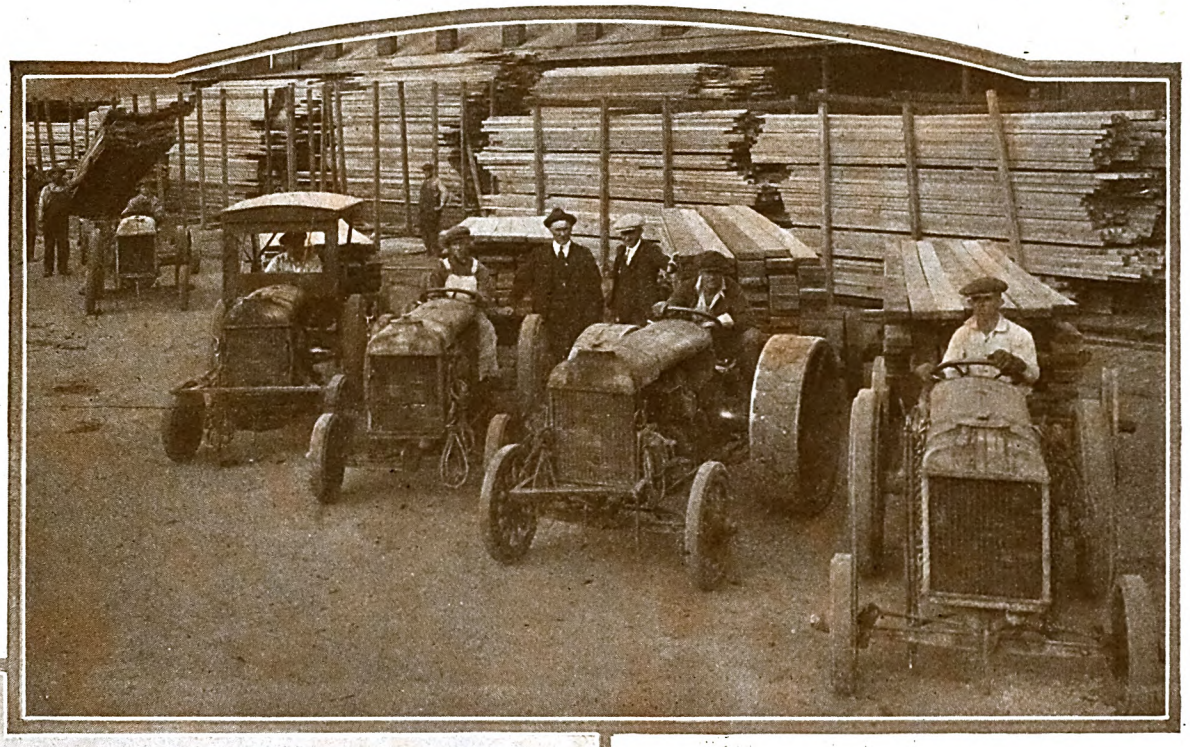
Carload shipping and receiving within the building. Notice the compartments along the platform.

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Is the Field of the Gasoline Tractor Limited?

After Looking at These Examples of Gasoline Tractors in Operation, What is Your Opinion?

By M. W. Potts



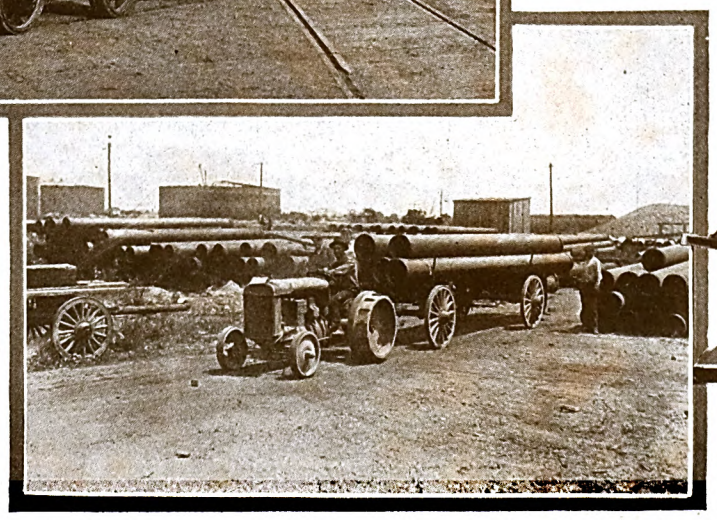
Five of the gasoline tractors being used by the Hammond Lumber Company of Los Angeles, California. These machines have been "treated rough" but are still giving satisfactory service.



Tractors hauling an Elevating Grader and two wagon trains, at Savage—Prior Lake, Minnesota. The Grader is traveling at a speed of 3 miles per hour. After the wagon trains are loaded they haul the load away at 5 miles per hour and return empty for the next load at a speed of 8 miles per hour.



After much effort the gasoline tractor is now being used more extensively on the heavy hauling at wharfs and piers. These tractors are large and heavy, built for heavy duty and service.



The gasoline tractors are slowly working into industrial plant work. This unit is being used by the Standard Oil Company and has saved them over $4,000 per year. They use a number of them about their yards for all kinds of work, and feel that each is producing a savings as large as this unit. The wide wheel is used to provide for bad road conditions.

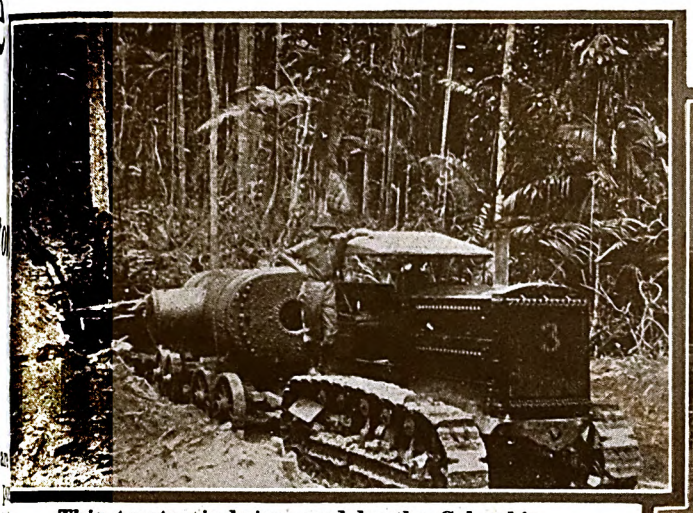


Snow makes hard going for horses but the gasoline tractor of this type will run over any kind of surface. In winter some of the small outlying towns off the railroad main line have trouble getting freight and supplies. This tractor is hauling a sled of supplies in Maine.

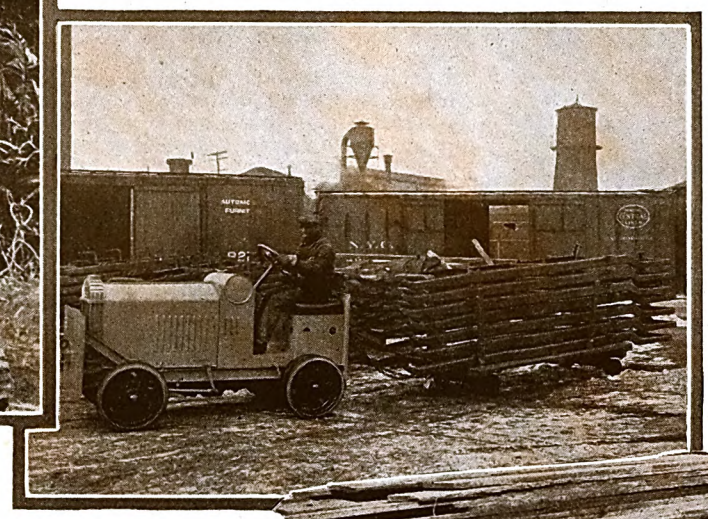
THERE are very few pieces of portable equipment that do not have one or more competitors. This is especially true in the field of material handling equipment. In this field the competition is very broad and is not limited to a difference between makes of any one type but includes the competition of different types of equipment. For instance: On the handling of materials about the yard of the plant, it can be argued that this work should be done by hand labor, by electric storage battery tractors, or by gasoline tractors. Unless all the factors entering into the problem are carefully scrutinized and understood, the wrong equipment can easily be installed with resultant failure instead of success.

It is difficult to argue broadly on this subject because every success of an installation of this class of equipment rests on the details that comprise the work to be done. The writer can therefore only show examples of what has been accomplished by the use of gasoline tractors and give a brief analysis of his own opinions why the field of the gasoline tractor, at first glance, seems to be limited. It will be noted that he says, *seems*, but like other engineers he is now of the opinion that new improvements in the design of the

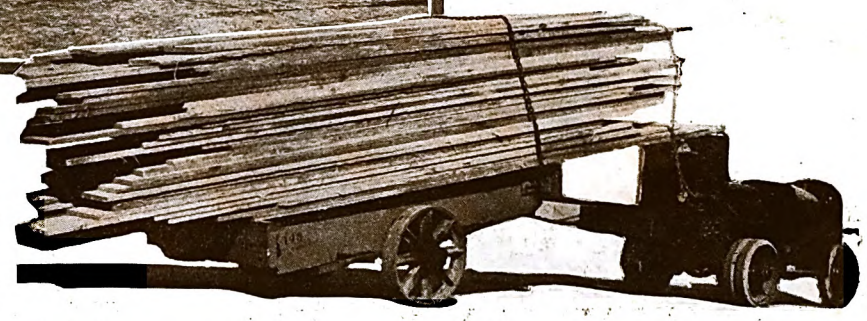
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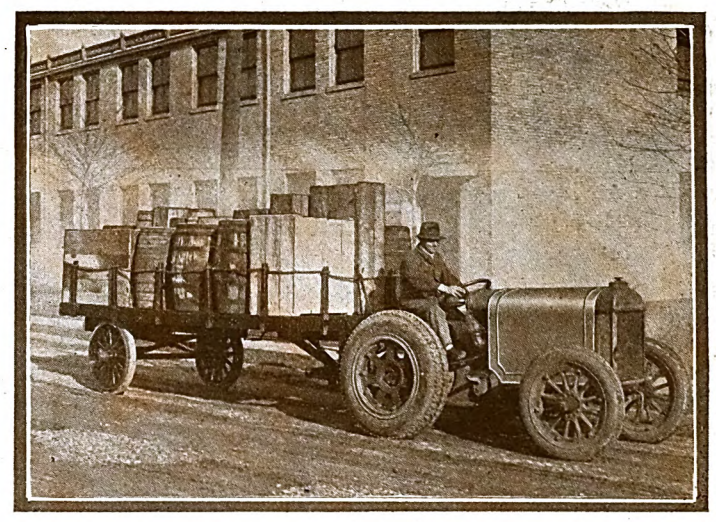
This tractor is being used by the Columbia Syndicate of South America for hauling oil field equipment to remote places. It has been found cheaper to clear a track for the tractor than it is to lay rails for a railroad. This tractor is also used in setting up the plant and clearing the site.



Industrial plants are beginning to use the gasoline tractor for general heavy hauling about the plant yard. This machine is now in service at the plant of the Peerless Motor Car Company and has been found very satisfactory. This is only one of the many uses made of this equipment.



As stated before, lumber yards have made extensive use of gasoline tractors. No matter what type of trailer equipment is being used it is always possible to make a hook-up between the tractor and the trailer. Compare the trailer shown in this photograph with those shown elsewhere.

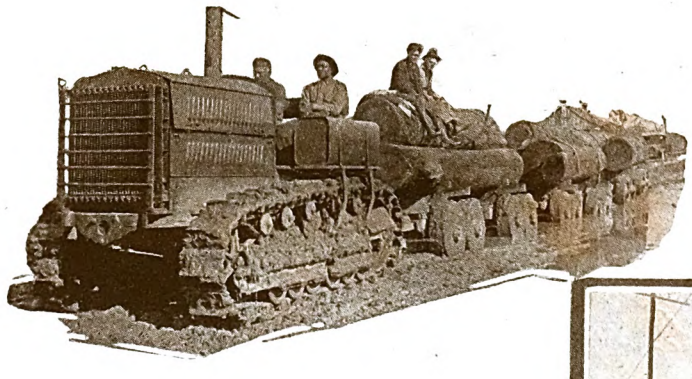


The tractor in this instance is equipped with pneumatic tires to eliminate road shock. The trailer has a 38" loading height and is called a Semi-Trailer. It can be connected or disconnected without the driver leaving his seat, and when disconnected rests on a substantial hinged prop, thus permitting the tractor unit to haul a second trailer while the first one is being loaded or unloaded.

maller gasoline tractors has reatly broadened their field.

The gasoline tractors of a ew years ago were large, cumersome machines that had difficulty negotiating in narrow sles and through narrow oorways such as are found in ue average industrial plants. istead of the manufacturers ctifying this limitation by anging the design of their uipment, they found it more pedient to change the field operation for gasoline tracrs; consequently they took e line of least resistance and veloped the use of this equipent on outside work that did t require small compact maines. Thus we find the greatt number of gasoline tractor stallations on roadwork, lumr yard haulage, construction ojects, farms, etc., and very v installations within indusal plants.

After the above mentioned ld had been developed it beme necessary to broaden out, t again the size of the manes was the deciding factor ainst them. It was, however, ssible to use these large manes on warfs, bulkheads, and ound supporting warehouses conjunction with the unloadof ships. This use of the soline tractor brought about new designs of small comt gasoline tractors that are the market today. It was nd that some of the elecstorage battery tractors



The tractor shown is doing the work of 18 mules and doing it quicker and cheaper. The weight of the load including wagons is about 25 tons. There is approximately 3,500 feet of hardwood in the load.



Stone Quarries and Marble Works have found the gasoline tractor of value in hauling heavy loads between the quarry and the finishing plant or monument works. This shows a 9 ton load being hauled by one tractor for the A. Weiblen Marble & Granite Company of New Orleans, La.



The lumber industry uses all makes and types of gasoline tractors. In a number of instances these tractors are performing the work of many horses about the mill and storage yards. Observe how easy it is to hitch a regular horse wagon to the tractor.

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How many men would be required to move this concrete mixer up the grade? This is only one of the many uses that can be made of a gasoline tractor.

This rotary sweeper is a great time and money saver to the industrial plant that has to clean its own roads. The broom is balanced, raised and lowered, stopped or started by special devices. While it takes its power direct from the engine, it is driven independently of the motion of the unit.



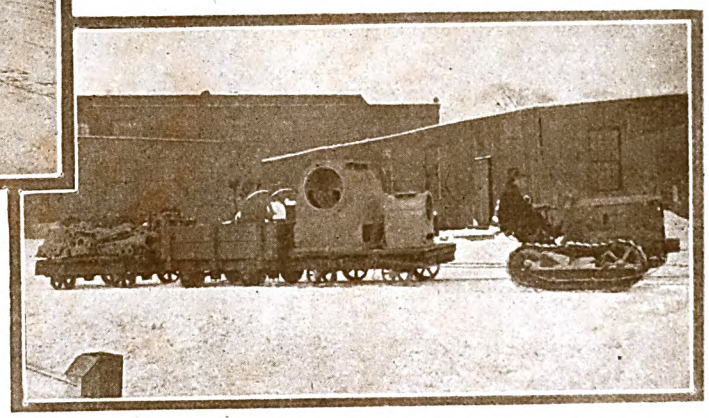


The Globe Seamless Tube Company use gasoline tractors for hauling trailers in all departments of the plant. This photograph shows one working over uneven ground, hauling refuse material to the dumps.



Industrial plants, towns and cities have found the gasoline tractor to be the best medium in connection with their snow removal. Several types of plows have been designed to operate with the gasoline tractors.

The Worthington Pump & Machinery Corporation of Holyoke, Mass., use a gasoline tractor as a locomotive on their industrial railroad. They also find it advantageous for hauling heavy loads about their plant where tracks are not provided.



operating on docks and railroad transfer floats had to carry a large battery capacity in order to operate the full day, and even with this large battery capacity it was necessary to give them a booster charge at noon. The gasoline tractors were brought into service on this work but they had trouble operating in the confined aisleways and consolidation spaces due to their size. This brought about a change in design which has considerably broadened the field of gasoline tractors.

A few of the various types and makes of gasoline tractors are shown in the accompanying photographs. There does not appear to be any limit to the fields in which they *can* operate. The new design of tractors, more compact and with shorter turning radius, has opened the field of industrial plant haulage, which up to this time has been closed. Now the gasoline tractor can operate in narrow aisles and congested spaces in competition with the

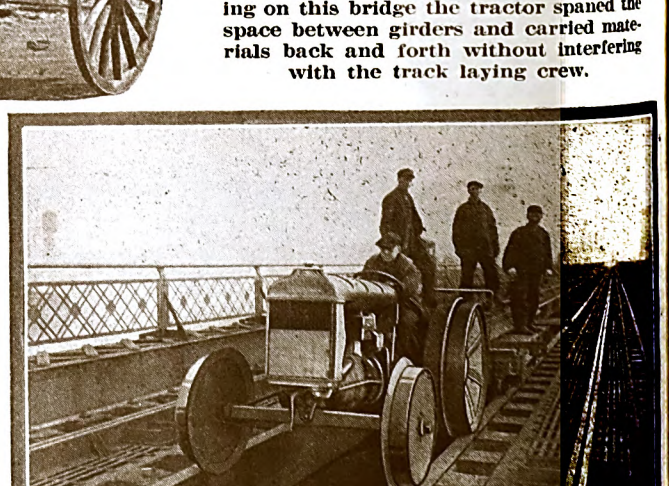
A number of industrial plants are modifying their horse-drawn equipment and purchasing gasoline tractors to replace horses for yard work. It should be noticed how many different types of trailer equipment are being hauled by these tractors.



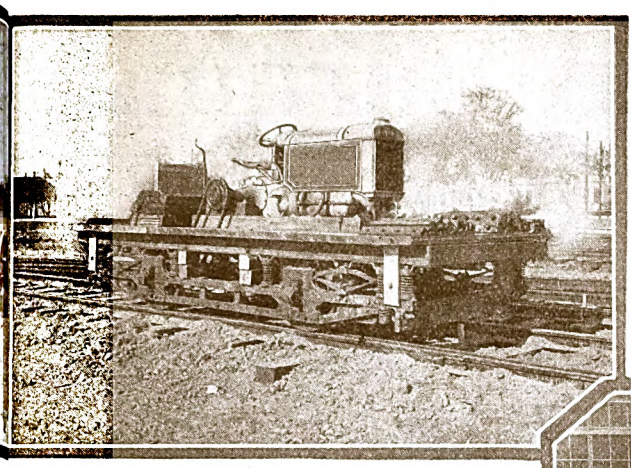
Spotting cars and making shifts in the daytime is often impossible because the "Regular railroad locomotive only makes one shift per day." To move a car 50 or 100 feet will often save many dollars.

The Vulcan Steam Railway Company found use for a gasoline tractor in building bridges and laying tracks. In working on this bridge the tractor spaned the space between girders and carried materials back and forth without interfering with the track laying crew.





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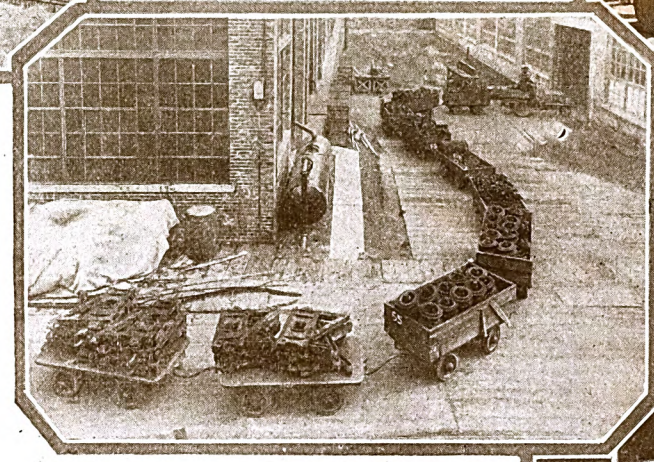


Various means have been employed for using gasoline tractors as locomotives to operate on rails. This unit, operating as shown, pulled a 45 ton load over a test period. The maintenance cost over 6 months' constant use has been less than $10, chiefly for regrinding valves.

lectric storage battery tractors.

It has been shown that there s a type of tractor particularly dapted to every industry and hat every industry can economically use one or more gasline tractors. The captions nder the pictures tell the tory. The uses shown are only few of the many that have een made of this equipment roughout the country. As ese tractors are now being sed in industrial plants it natural that new uses re being developed. Why en need we feel that the eld of the gasoline tracr is limited? We need not. nd if the tractor manufacrers will slightly change their esigns and make them more mpact they will find that inustrial plants can use their uipment. That has been the perience of one gasoline tracr manufacturer who now

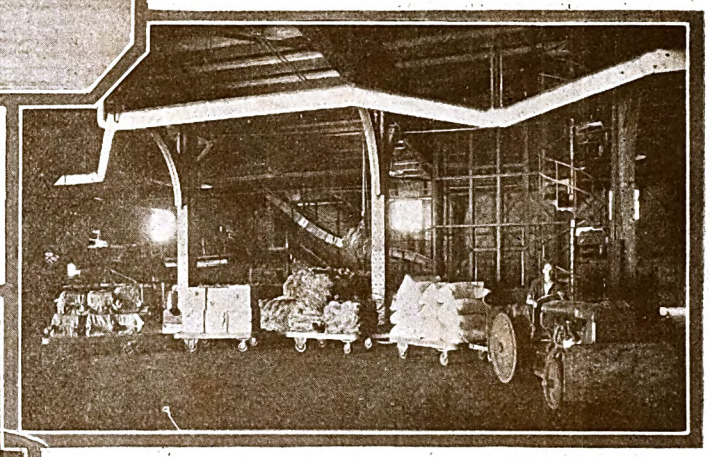
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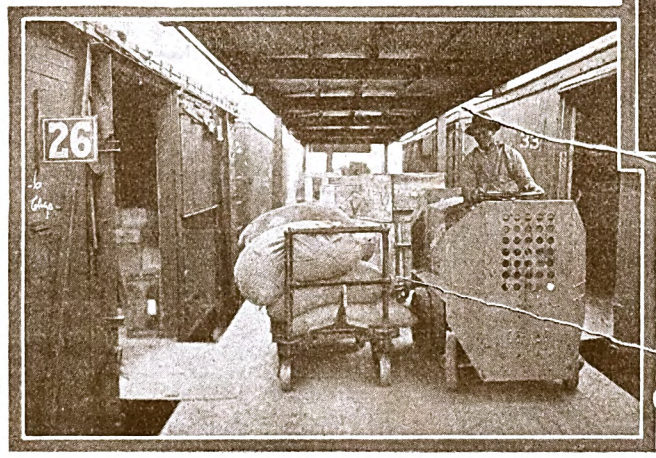
The tonnage of this tractor train is not known. The trailers are of the four-wheel-steer type and are roller bearing equipped. Note how each trailer follows the preceding one. How many men would it take to move this load?



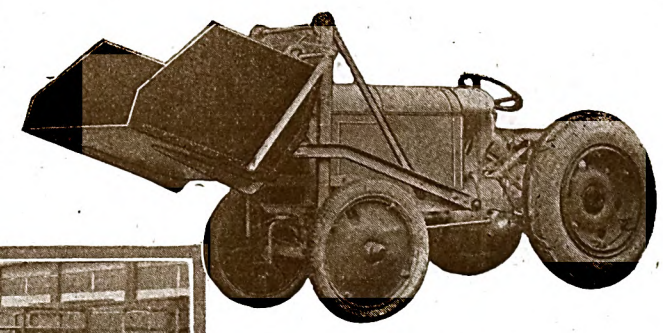
On grade work the gasoline tractor is in its element. Many industrial plants whose operating floor is above the yard level have found them most efficient for hauling raw materials into the shop. This is a good example of the class of grade work that the gasoline tractor can negotiate.



The Stevedoring firm of T. Hogan & Sons. Inc. on pier 58, North River, New York City, which belongs to the International Mercantile Marine Co. (Atlantic Transport Line) have found this tractor trailer method of hauling freight to be very efficient and economical. The trailers are of steel construction and roller bearing equipped.

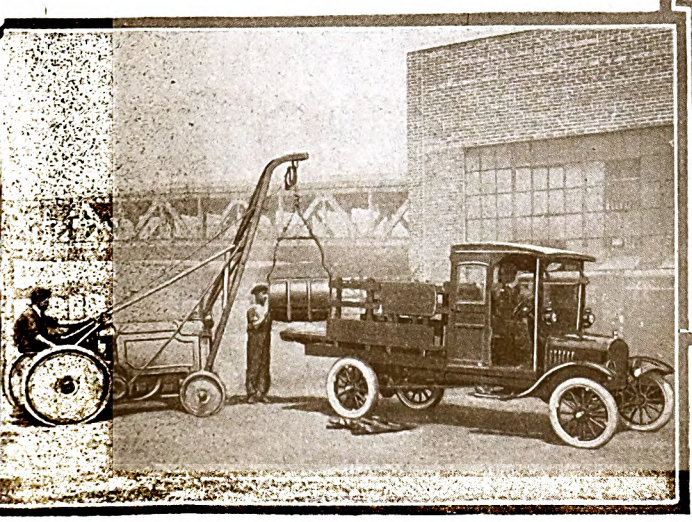


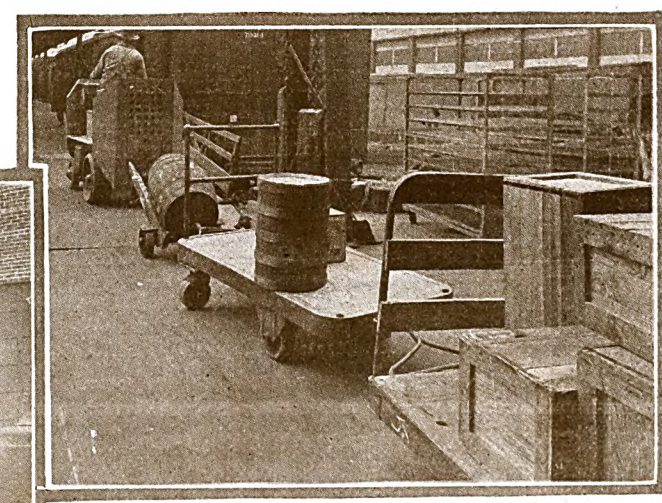
For years the gasoline tractors have been large and cumbersome. The latest, designs in gasoline tractors, are closely following the small compact lines of the electric storage battery tractors. This gasoline tractor can operate in narrow aisles and conjested spaces, it has a turning radius of 5'-3" It is shown operating on a railroad float.



The automatic dump scraper attached to a gasoline tractor unit, loads its own scoop with half a yard of dirt or other material, carries the load to what ever point is desired and dumps it there, all these operations being performed by the operator without leaving his seat.

This portable traveling crane is integral with the gasoline tractor unit and is operated in connection with a capstan winch on the side of the tractor. It will raise a half-ton load 9 feet from the ground, and while so suspended the load may be carried to any desired location and lowered with perfect control. All operations are performed by the driver without the necessity of leaving his seat.





For hauling freight from bulkhead to cars on floats the gasoline tractor has been found very efficient. The ramp between float and bulkhead is often on a steep grade due to high or low tide. This grade work has been a stumbling block for the electric storage battery tractors.

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The Preparation and Burning of Pulverized Coal

Equipment and Process that Cuts the Coal Bill

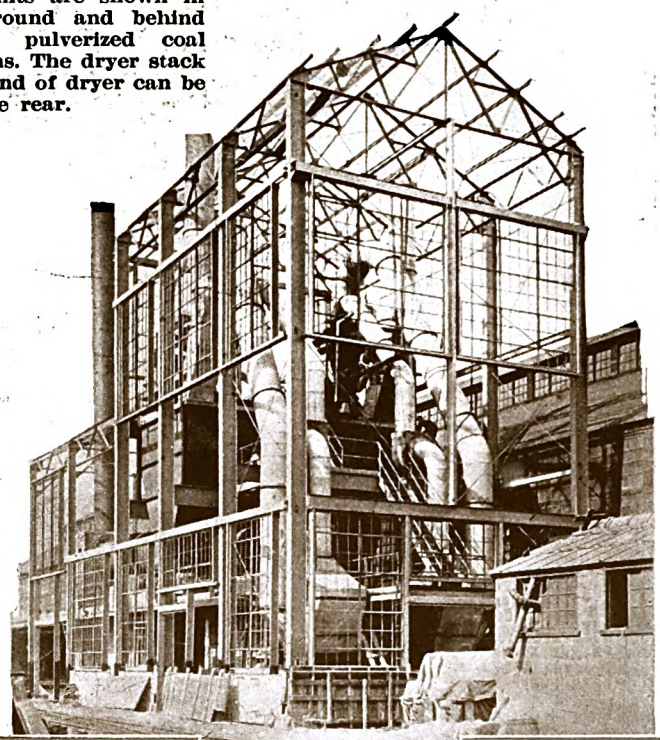
By Homer L. Rank

IT IS an astonishing but well-established fact that the possibilities of pulverized coal firing are not generally known, even in engineering circles of large diameter and wide range. For example, only those members of the profession or men whose industrial duties have compelled them to delve into archives of cost-reducing devices, realize that patents on coal-pulverizing machines for direct firing were granted nearly eighty years ago! It is more generally known that finely ground coal has played an important part in the manufacture of Portland Cement for many years, having been burned in that form in kilns where cement "clinker" is made.

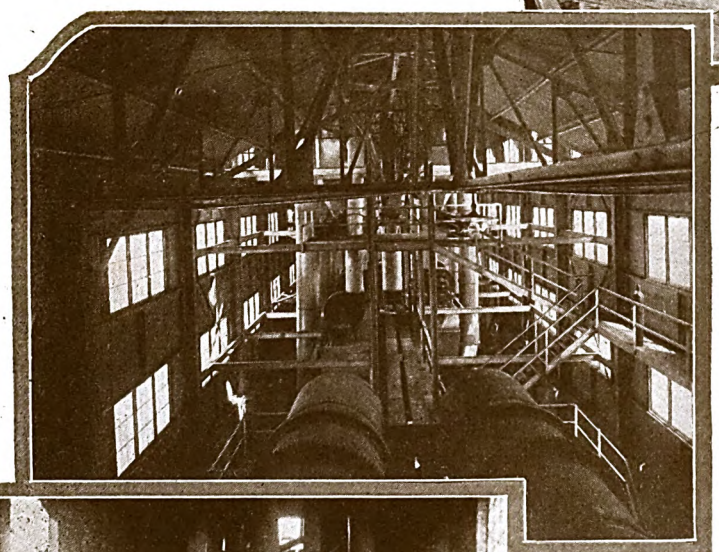
Thanks to the years of improvement and development in the Cement Industry, coal pulverizers—machines for reducing bituminous coal, lumpy, to powder—have long since passed out of the experimental field, and there are several machines on the market today, successfully performing this function, economically and with uniform results, regardless of the quality of fuel fed to them.

Why is it necessary to reduce coal to powder form, spending thousands of dollars for equipment to perform this work, and what are the *direct* advantages to be gained, over present modern methods of mechanical firing?

Before attempting an answer to this important compound question, it may not be

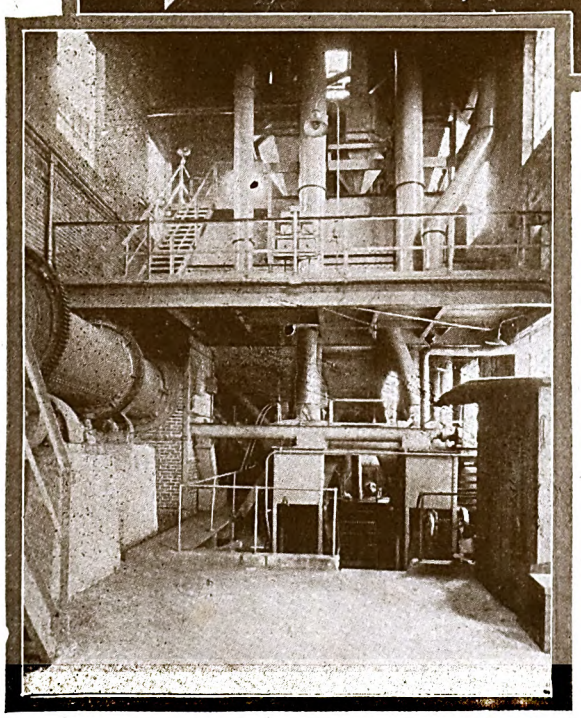


Central coal pulverizing plant during the process of construction. Two large pulverizing units are shown in the foreground and behind them are pulverized coal storage bins. The dryer stack and feed end of dryer can be seen in the rear.





Above—Two views of the interior of coal pulverizing plant showing details of pulverizer and silent chain drive together with exhauster and separator above pulverizer.

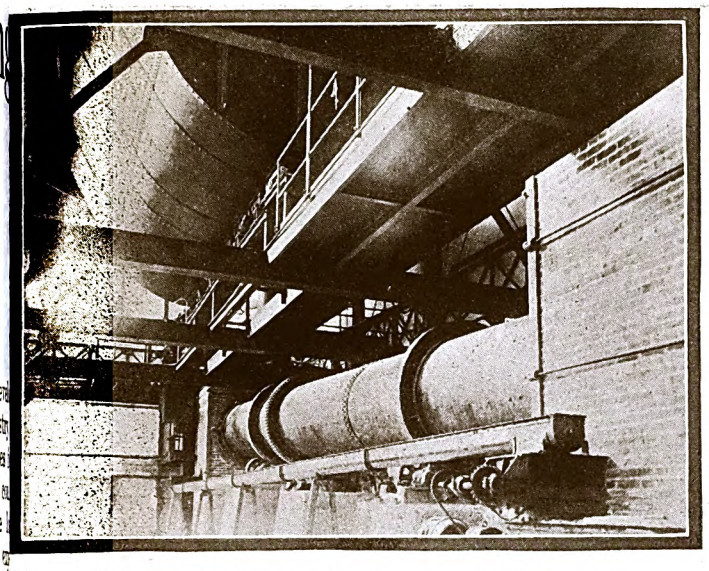


Coal dryer on the left and pulverizers behind the small feeder bins in the center, below. The coal dust collectors on top of the bin are shown above and the low pressure fan together with distributing pipe is in the left rear behind the pulverizers.

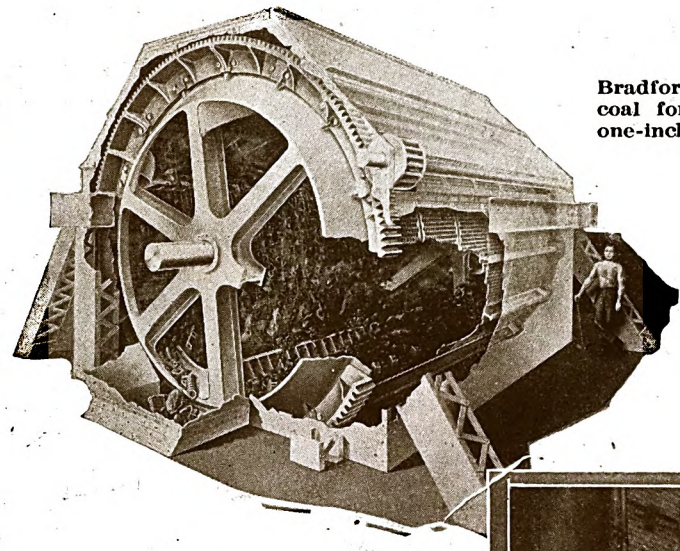


Upper floor, showing exhaust fans which deliver coal and air from pulverizer to coal dust collectors located over storage bins. The air returns down center pipe to pulverizer.

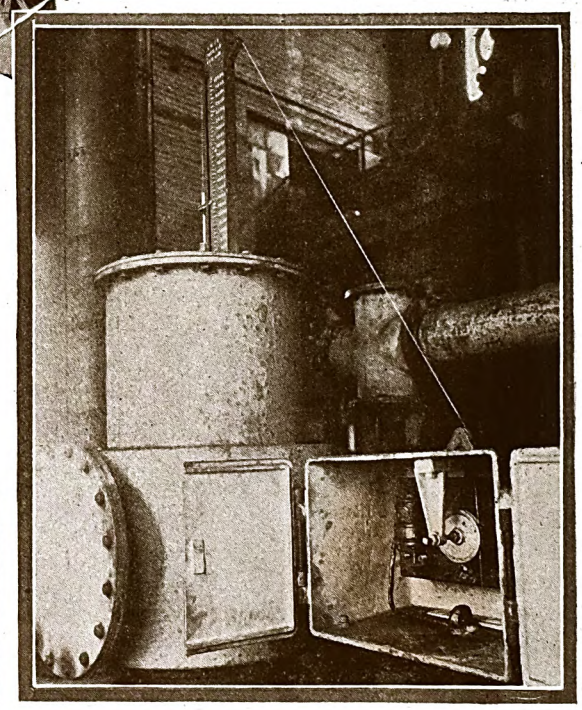
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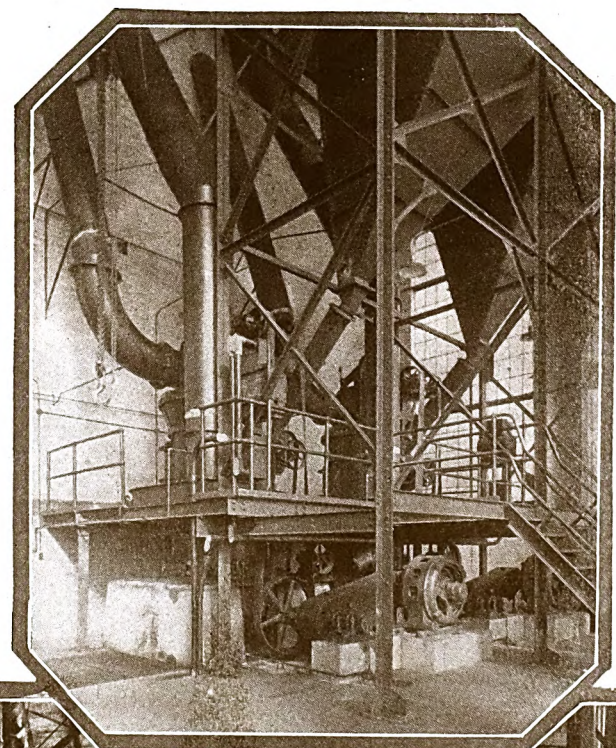
Storage bunker, with conveyor under same, delivering through automatic scale to rotary dryer.



Bradford Breaker; which prepares the coal for pulverizing, by crushing it to one-inch size.

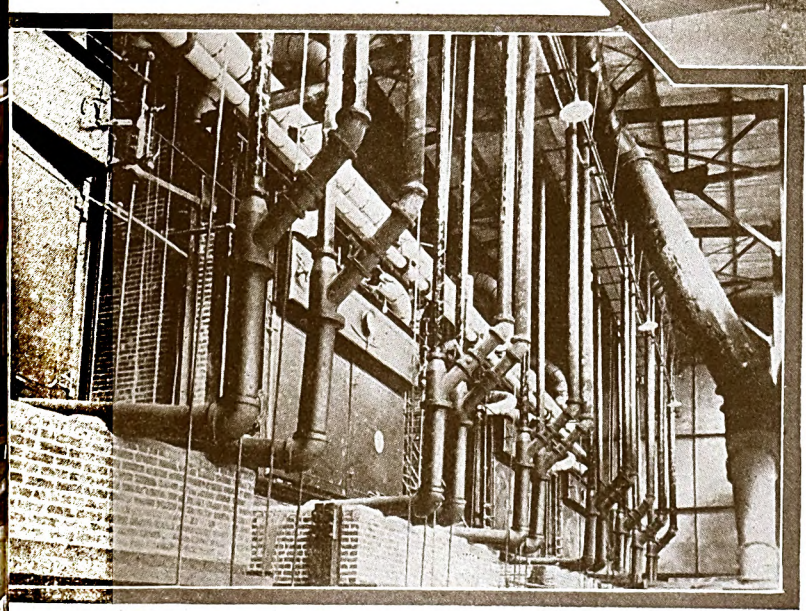


General view of a 2-mill preparation plant, showing dried coal storage bins overhead. Note well lighted, accessible arrangement of machinery.

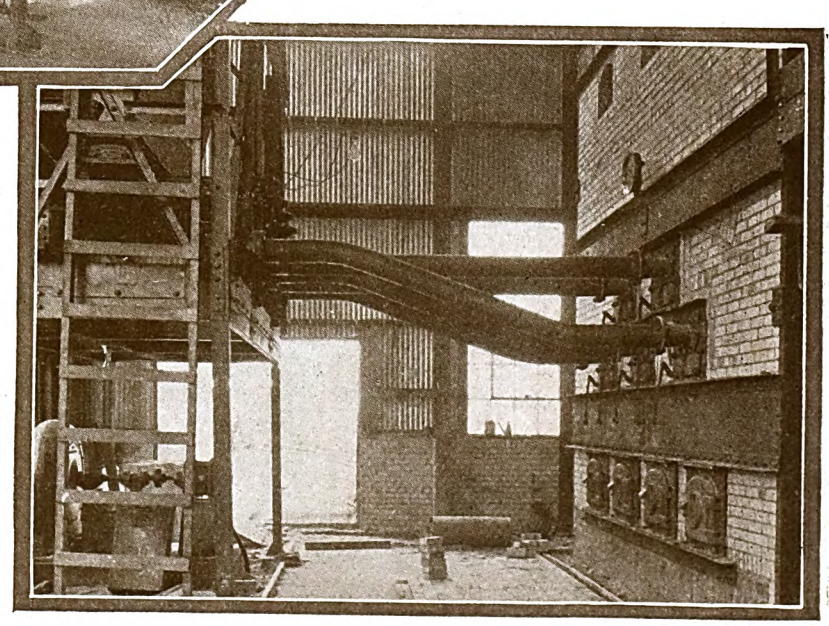


Automatiq mechanism for feeding pulverized coal from the central storage bin into the low pressure air distributing circuit in fixed proportion to the amount of air flowing. As more burners are added or cut off from the circuit, a float in the left-hand chamber automatically raises or lowers, thus changing the position of the rheostat in the box.

amiss to paint a brief word-picture, entitled, "Burning a Lump of Coal." Before the combustible content of a lump —a one-inch cube, for example —can be released for combustion, the lump must first be heated to the point where it develops more heat than it receives. No fuel will burn until the molecules which form it have been brought to this self-supporting condition by the heat absorbed from particles previously burned around it. Not only must the fuel itself be heated to the temperature requisite for combustion, but the air also, which surrounds each particle of fuel. A 1″ cube of coal exposes six square inches of surface area for absorption and liberation of heat, while the same cube, pulverized so that 90% will pass a 200-mesh screen, exposes an area of approximately *eight square feet,* at the same time

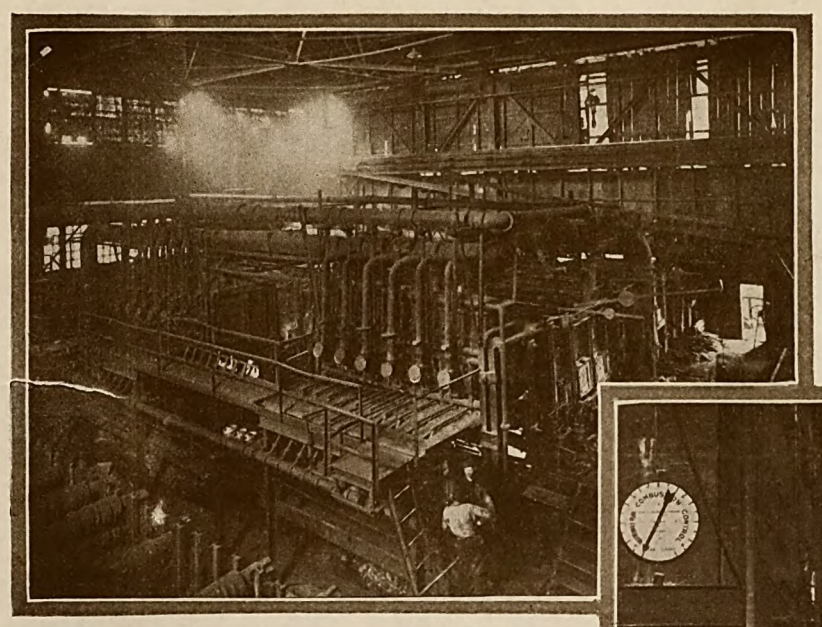


Application of pulverized coal to 4—750 hp. boilers. The inside vertical pipes carry a mixture of coal and air from the pulverizing plant. The right-hand vertical pipes furnish the necessary additional air to produce proper combustion conditions at the burner tips.

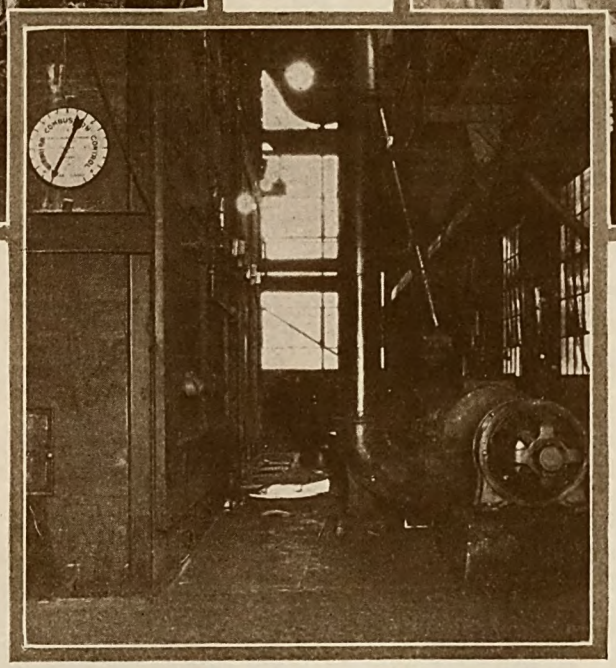


Showing method of firing combustion chamber under boiler, from individual storage tanks (shown on the left) by means of mechanical feeders and secondary air blast.

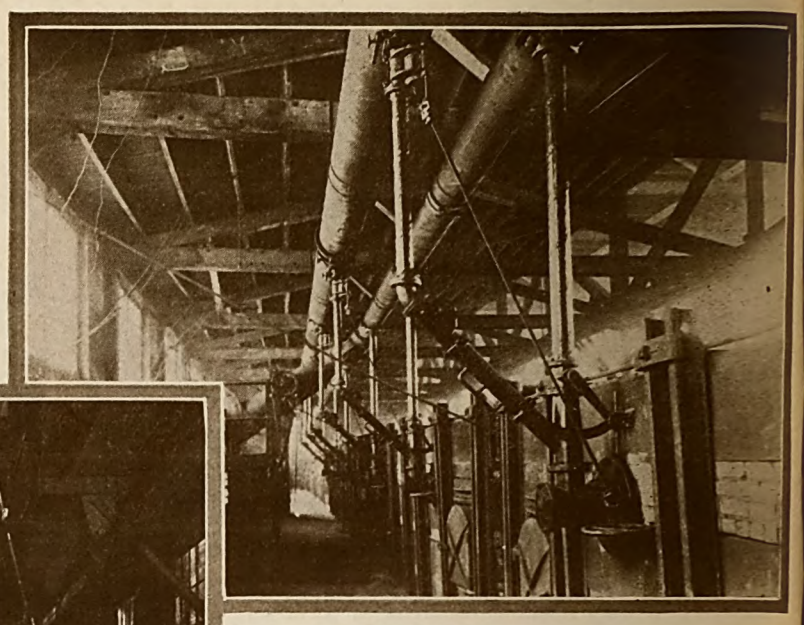
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Rod heating furnaces for nut and bolt machines fired with pulverized coal. The upper pipe circuit carries a mixture of pulverized coal and air. The lower pipe furnishes necessary additional air at the burner to permit perfect combustion.



Typical application of the "direct-firing" system. "Green" coal spouted from storage bunker overhead to pulverizer, (without preliminary drying) and blown directly to combustion chamber under boiler.



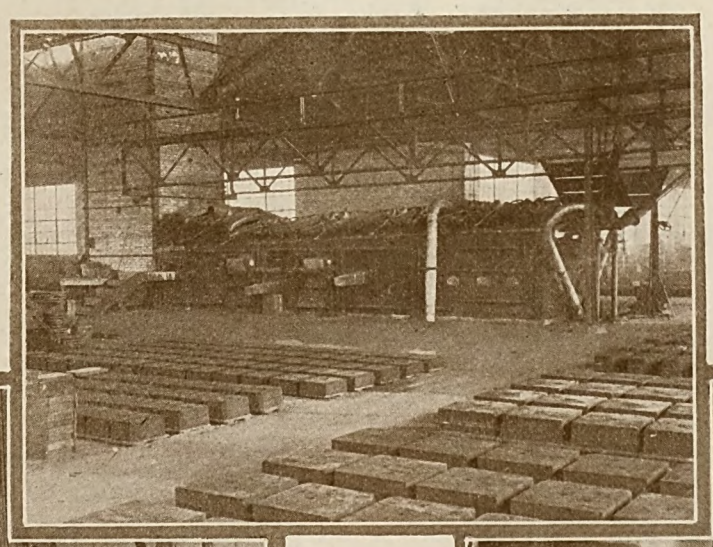
A row of malleable iron annealing ovens equipped with pulverized coal burners. The left-hand pipes contain a mixture of pulverized coal and air. The right-hand pipes furnish the necessary additional air to support combustion in the furnace.

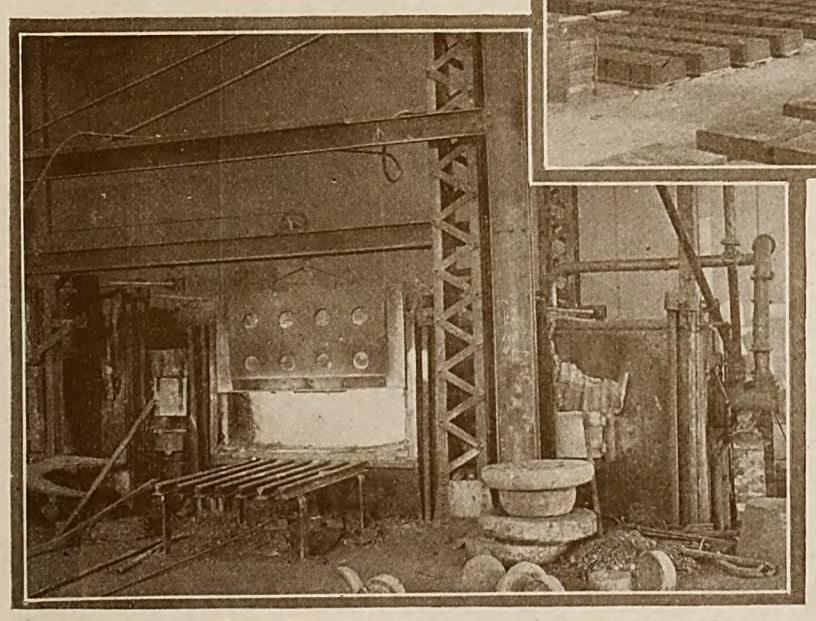
surrounding each particle of coal with sufficient oxygen (carried in fan-fed air) to cause its instantaneous and complete combustion. A simple calculation shows that the power to burn has increased nearly seven hundred times. It becomes immediately apparent that, in a bed of fuel as on a mechanical stoker, a certain amount of heat units are wasted, due to the fact that some heat is lost from incandescent particles, while bringing up the temperature of the cold particles surrounding them, this loss being proportional to the percentage of large lumps of fuel and quantities of excess air to be heated. Further, it is readily seen that coal, in pulverized form, is *fully prepared* for complete and immediate combustion (as witness the flame at the end of a typical pulverized coal burner). The coal and "secondary air," having been properly mixed in a chamber just outside the burner, enter the furnace at a velocity of several thousand feet a minute. The flame plays right up against the metal burner, without smoke, clinkers, or ash, except an almost impalpable powder, which disappears in the air, much the same as mist before the sun.

It is not difficult to conclude, in a general way, that coal can be most economically burned—industrially—in pulverized form. Actual installations, operating over a period sufficiently long to prove every phase of the word "economy," in metallurgical work or steam

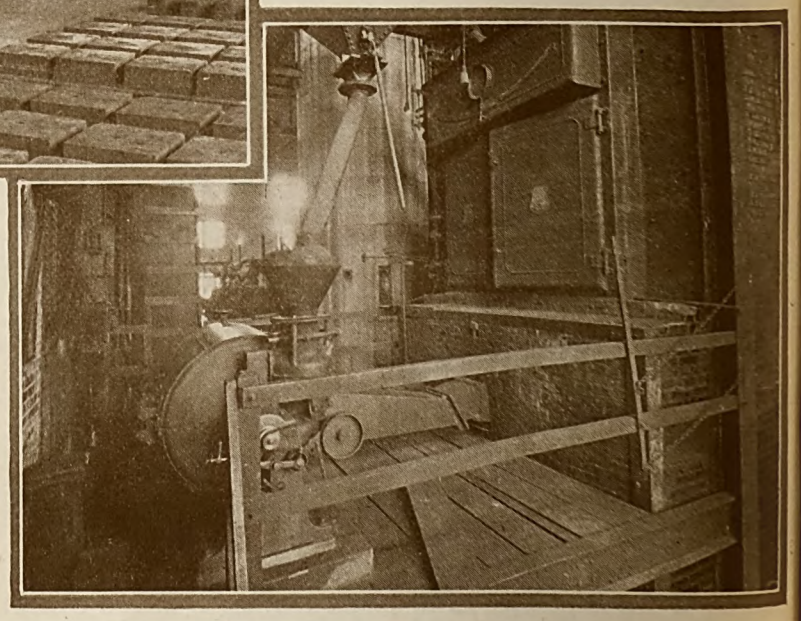
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Below—Typical malleable iron melting furnace showing moulding space around same and pulverized coal burners applied at the right-hand end.





Heavy billet heating furnace showing pulverized coal burners fired through end wall into combustion chamber.



Direct-firing unit applied to boiler. Undried coal passes from overhead storage through automatic feeder, to pulverizer, and is blown to combustion chamber. Note compactness of this self-contained unit.

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What Building Means to Business

The Close Economic Relation Between Construction Work and the Demand for Manufactured Products

By Ernest Bradford

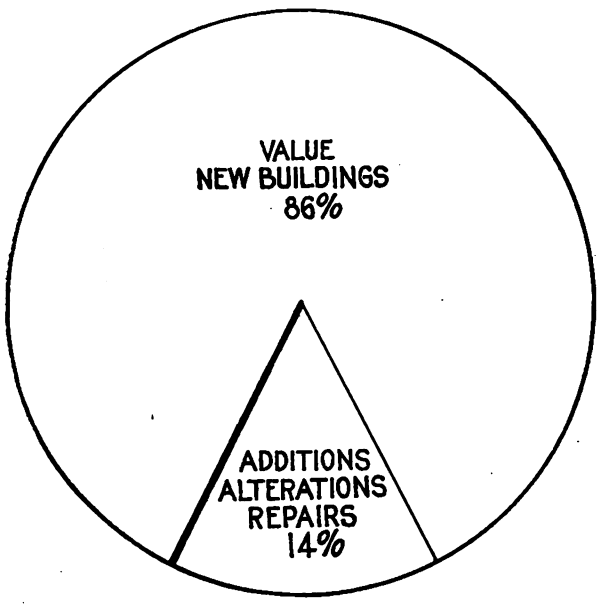


Fig. 1. A graphical presentation of the proportionate value of new buildings, to additions, alterations and repairs.

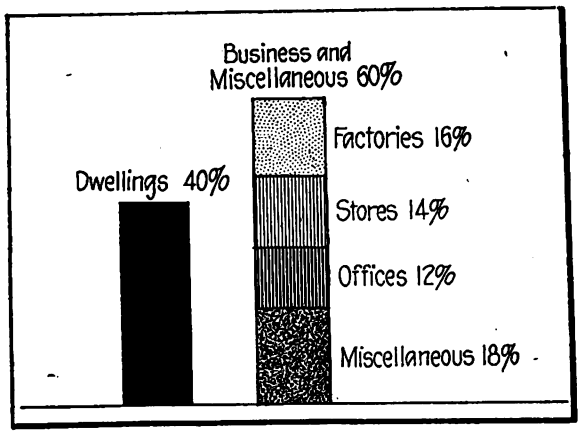


Fig. 2. Classification of Buildings constructed annually, showing proportions (value) of each type.

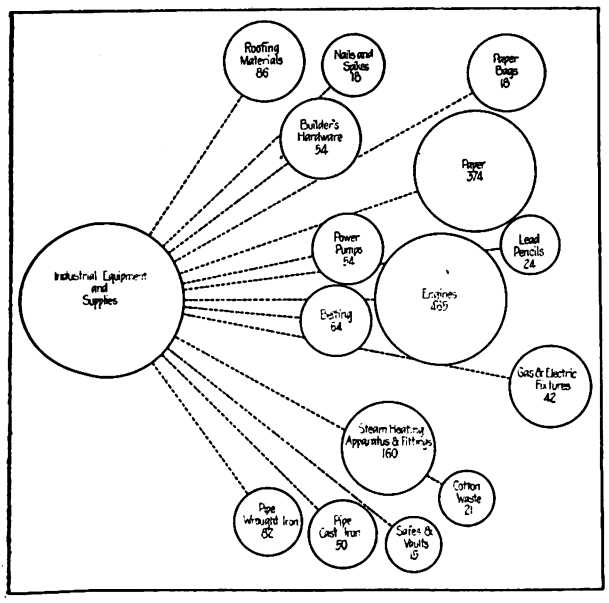


Fig. 4. The figures in the small circles represent (in millions of dollars) the value of the various items for the year 1919 and reported by the census of 1920.

THE manufacturer of products used in factories and stores, office buildings, dwellings or other structures, watching the unusual volume of construction work going on during 1922, has asked himself the question, what does building mean to business? Does it forecast increased sales for the butcher, the baker, the electric lamp maker, and all who supply their needs? Does it point to a greater demand for the products used by industrial concerns—power machinery, pipe, wire, conveyors, steam turbines, trucks, lubricating oil, waste, hose, belting; and for personal consumption goods such as washing machines, refrigerators, furniture, textiles, shoes, foodstuffs, candy, books, mechanical toys? Just what does it mean to those who manufacture and sell factory products?

To bring together some of the available facts bearing on this live and timely question is the purpose of this article, so that as the season of 1923 begins, and buildings again go up on every hand, the significance which the volume of construction has as a barometer of industry may be more fully appreciated.

The primary position which building occupies in our business structure is obvious from a glance at its relation to the

(Continued on page 67)

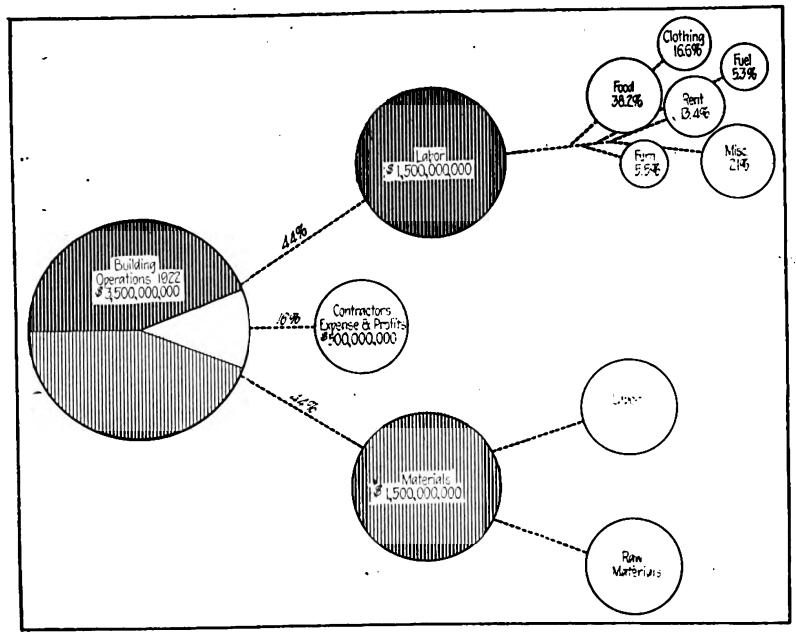


Fig. 3. Divisions and subdivisions of the "building dollar," showing where the 4½ billion dollars goes.

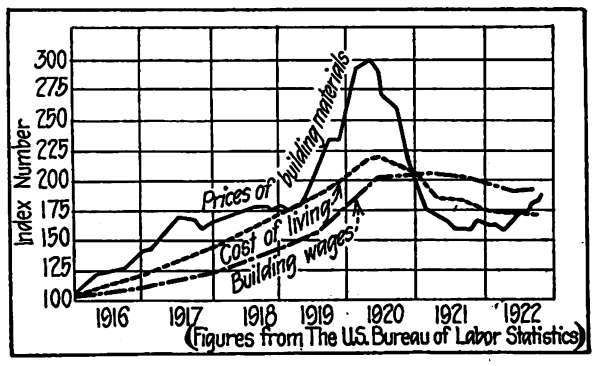


Fig. 5. A graphical comparison of (a) Building Materials Prices, (b) Building Wages and (c) Cost of Living, from 1916 to 1922, inclusive.

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Automatic

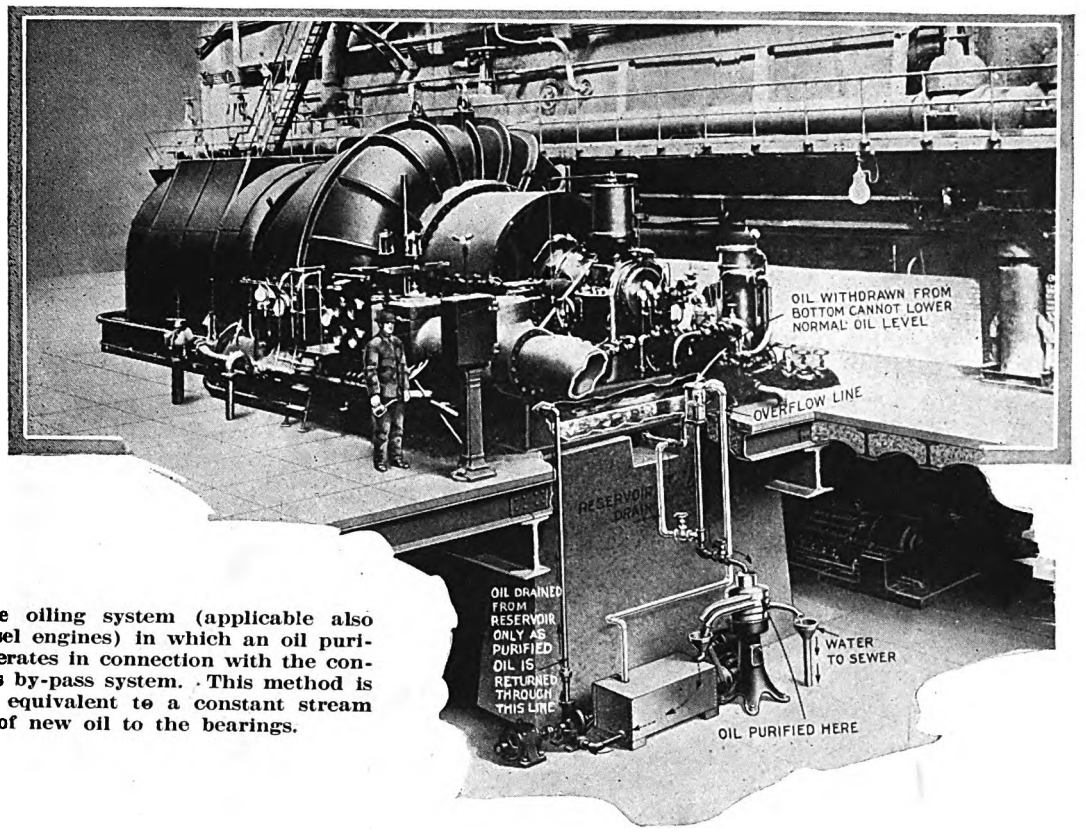
Making Sure of Proper Oiling,

By Allen

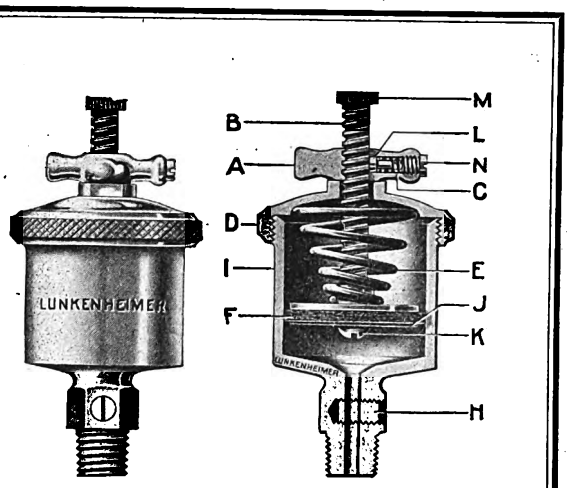
THE development of industrial machinery to its present-day state of efficiency has brought a marked influence to bear on the perfection of accessory equipment. There is no doubt that but for these latter appurtenances the modern power plant would be greatly handicapped in producing the steam and electricity so essential to our daily life.

Among the above equipment automatic lubrication devices play a most important part in insuring the constant and efficient operation of machinery at all times, the maintainance of repair expense at a minimum, and the economical and positive usage of lubricants. Lubrication today is looked upon as one of the most vital factors with which the operating engineer has to deal. The era of "hit or miss oiling" and the "old tallow pot" has passed into the discard, to give way to an age of scientific usage of lubricants that few of us ever anticipated. The relation that proper lubrication, systematically carried out, bears to general plant efficiency is admittedly one of the most important features of modern plant management.

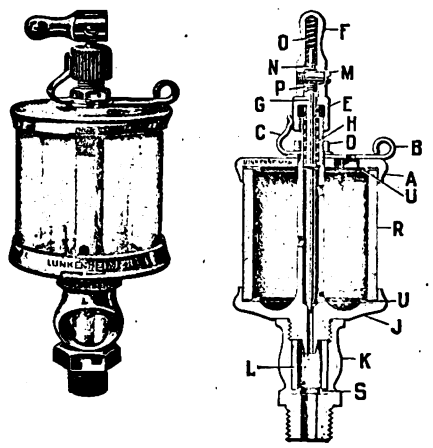
Automatic lubrication can be



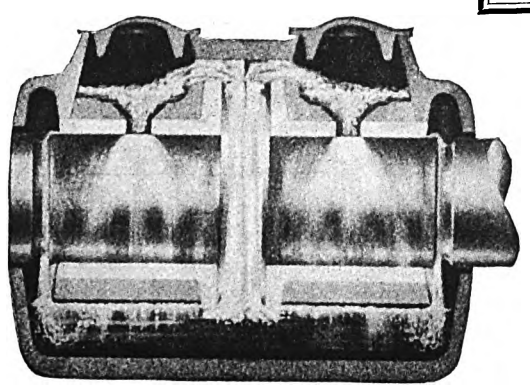
Turbine oiling system (applicable also **to Diesel** engines) in which an oil purifier operates in connection with the continuous by-pass system. This method is almost equivalent to a constant stream of new oil to the bearings.



Sectional and exterior views of a compression grease cup; a type of lubricator developed to meet the need for inexpensive installation and merely periodic attention.



Sectional and exterior views of a glass body oil cup, equipped with sight feed and snap layer for control of oil flow.



Phantom view of a fixed collar type oil bearing, commonly used on flour roller mills. Such a bearing is in reality an oil gusher, and flood lubrication is continuous.

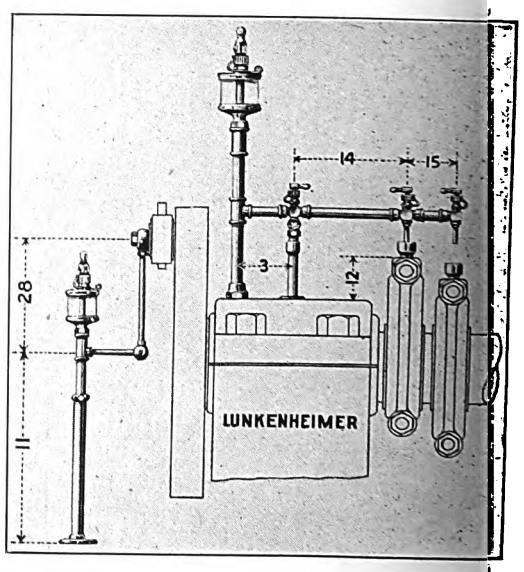


Illustration of equipment for oiling crank-pin, pillow blocks and two eccentrics by sight feed oil cup distribution.

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Lubrication

By Doing it Mechanically

F. BREWER

divided essentially into eight distinct classes, *i. e.*

Waste pad lubrication.

Sight feed oiling devices, and compression grease cups.

Self-oiling systems such as ring and chain oilers.

Gravity feed systems.

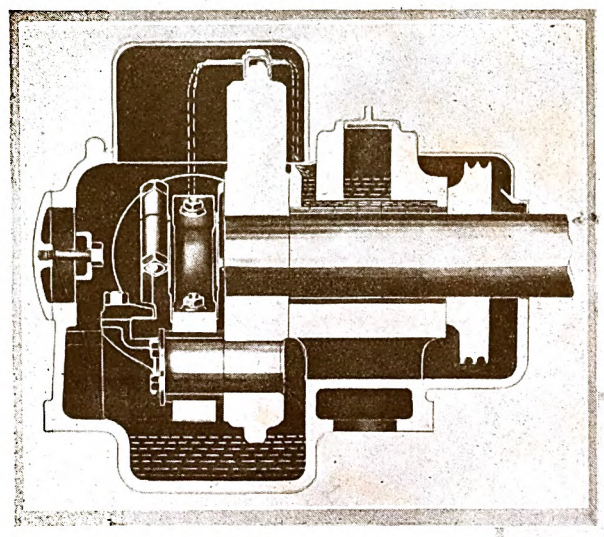
Circulating gravity feed systems.

Mechanical force feed lubrication.

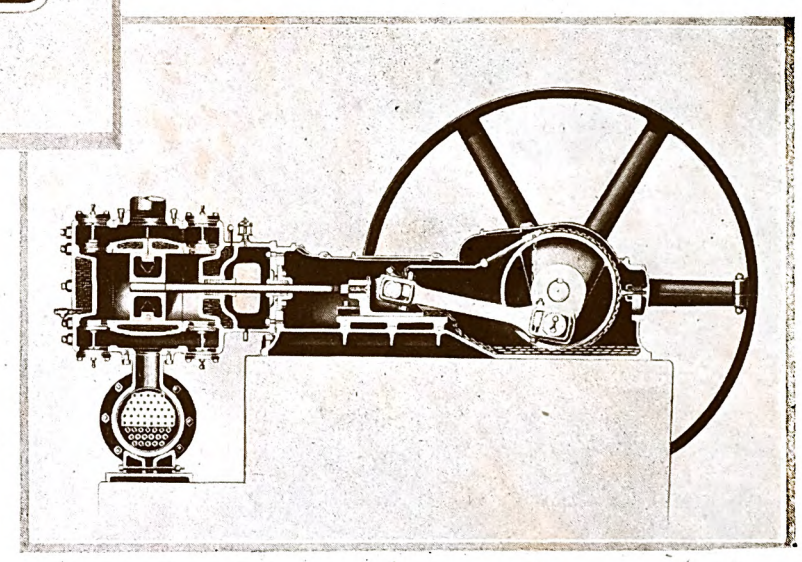
Splash lubrication.

Steam cylinder lubrication. (Hydrostatic and force feed.)

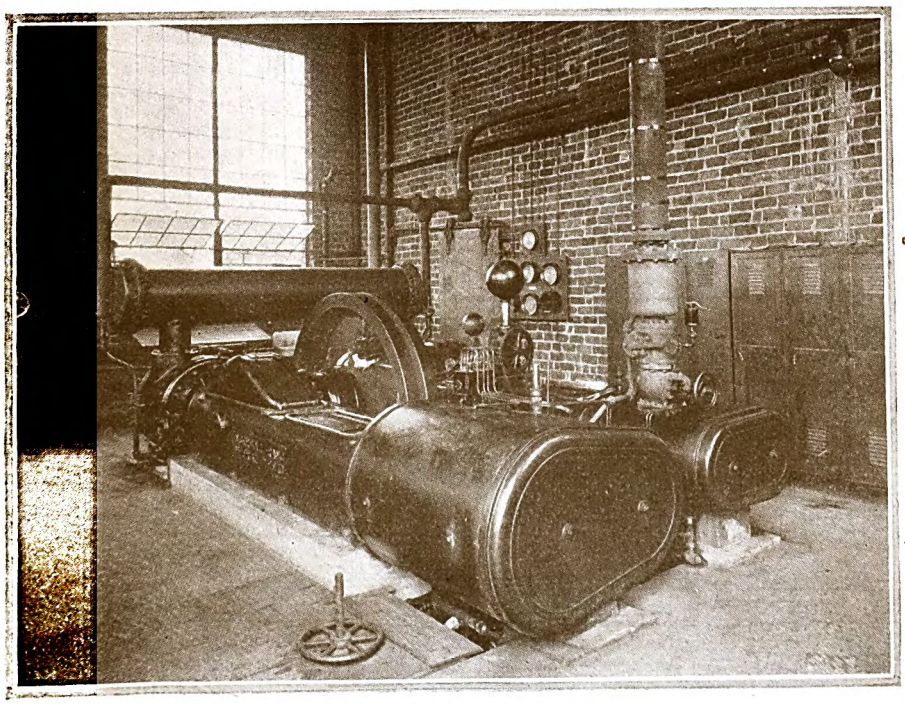
Probably the first departure from the crude method of oiling by hand feed with an oil can, was the adoption of waste pad lubrication. It was early appreciated that hand oiling was decidedly wasteful and most unsatisfactory since generally the oil would run through the bearing and drain out within a few minutes after application. So, to make the oil remain longer in service bearings were built with a shallow reservoir surrounding the oil hole, and a pad of waste laid therein. This was periodically saturated with oil and served a dual purpose: To prevent the oil from passing too rapidly into the bearing and to prevent



At the left—Illustration of the principles of crank case lubrication. This design enables the oil to be picked up by the crank disc and carried to the uppermost part of the disc. Here it is scraped off (as indicated below) and led to the crosshead pin and crosshead.



End view (cross section) of crank case of engine shown above, indicating the manner in which oil is distributed to the crankpin and other movable parts.



Typical example of modern automatic lubrication equipment installed on an air compressor. Note force feed lubricator with piping; auxiliary steam cylinder lubricators; and piping for splash feed oil distribution.

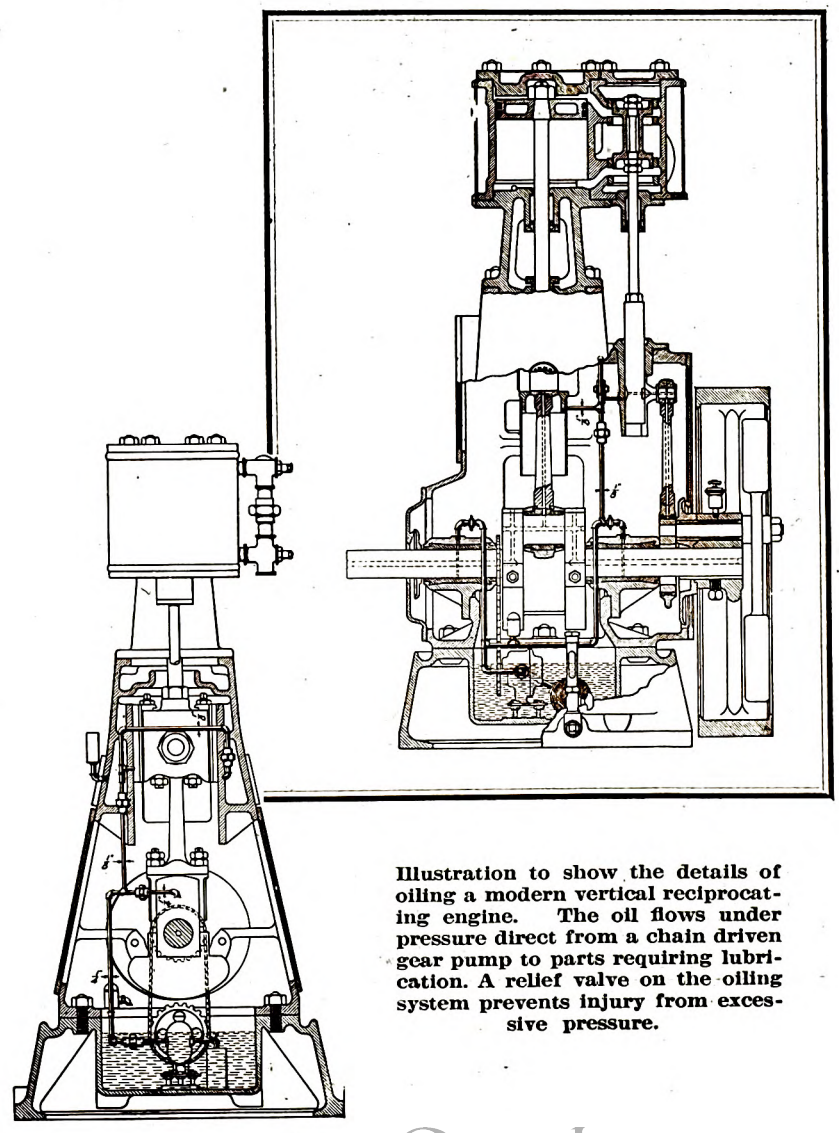
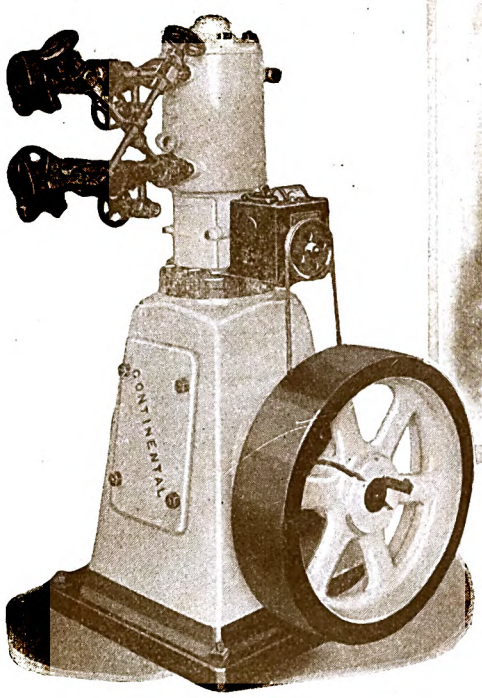
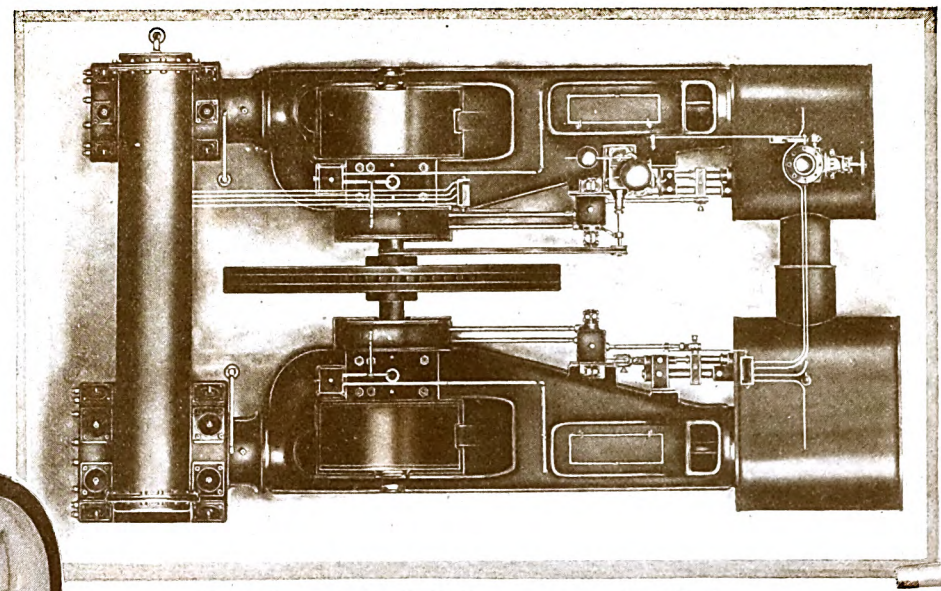


Illustration to show the details of oiling a modern vertical reciprocating engine. The oil flows under pressure direct from a chain driven gear pump to parts requiring lubrication. A relief valve on the oiling system prevents injury from excessive pressure.

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Ice Machine equipment with a single feed Force Feed Oiler installed.



Plan view of a typical air compressor installation equipped for automatic lubrication, using both force feed and splash lubrication.

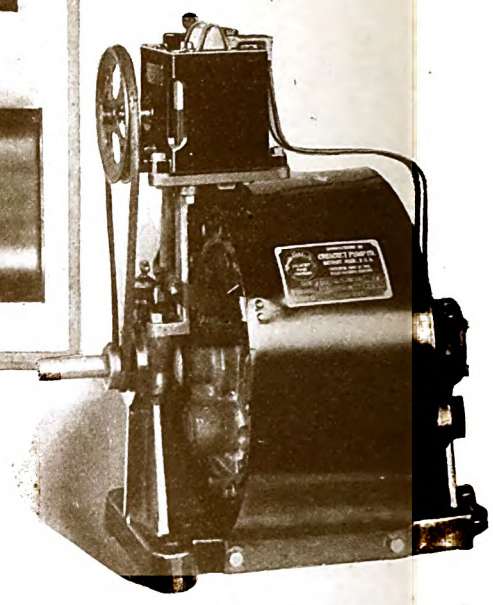
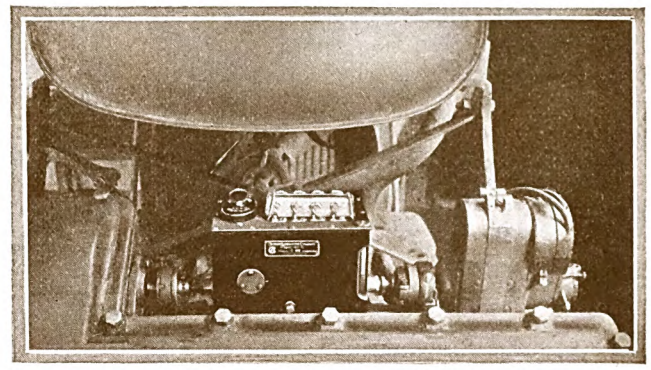
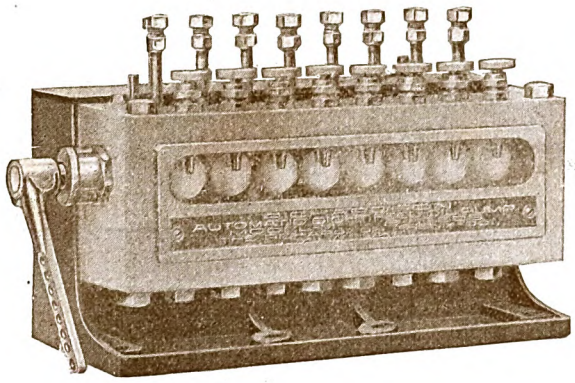


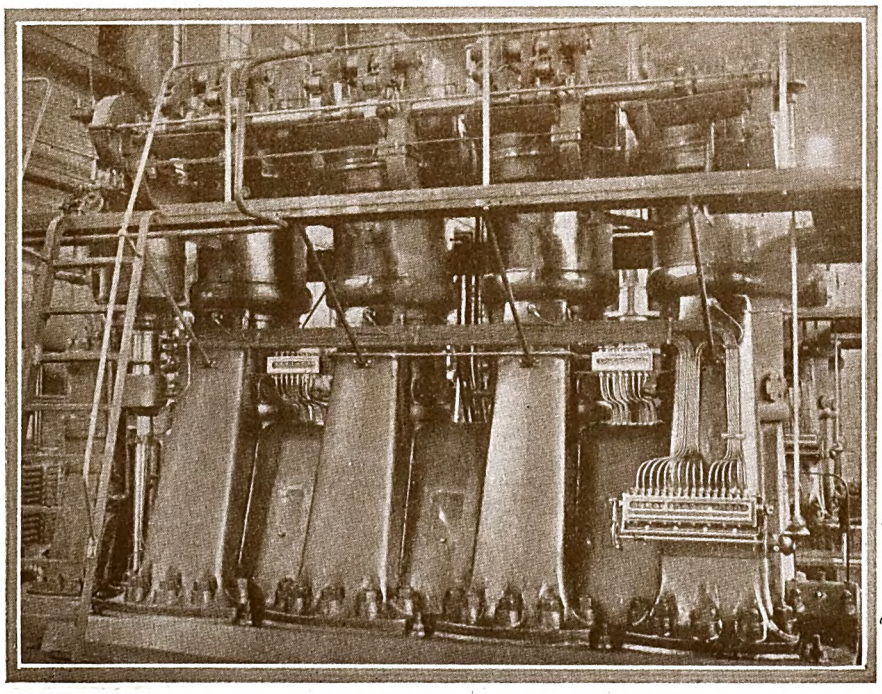
Illustration of a two feed type of Force Feed Lubricator installed on a Vacuum Pump.



A four-feed Force Feed Oiler with drive shaft extending through both ends, installed on an Aultman & Taylor Tractor.



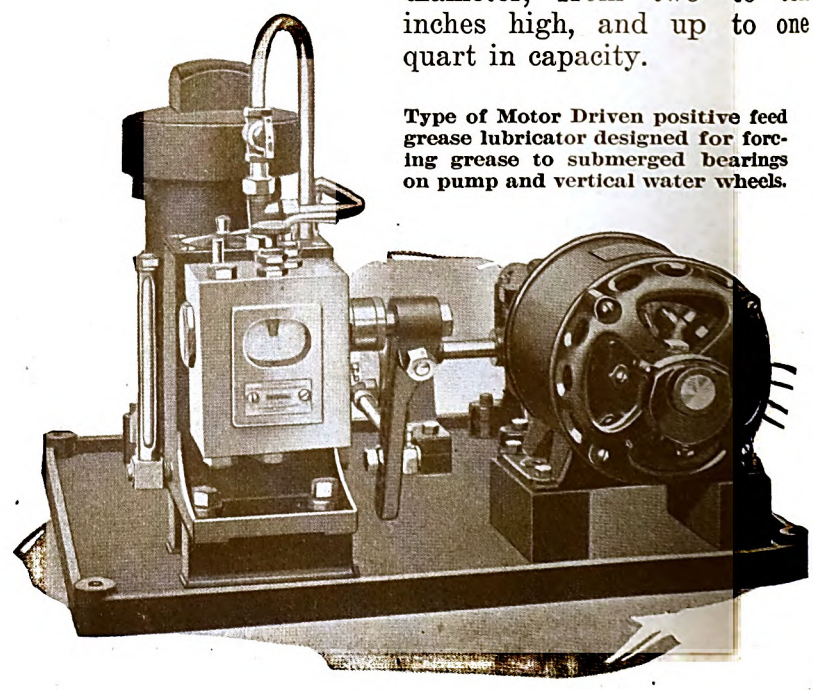
At the left—Exterior view of a modern mechanical lubricator manifold, with sight feed equipment.



Sixteen-feed lubricator on a Diesel Engine. This engine is also equipped with R-P multiple sight feed Oilers.

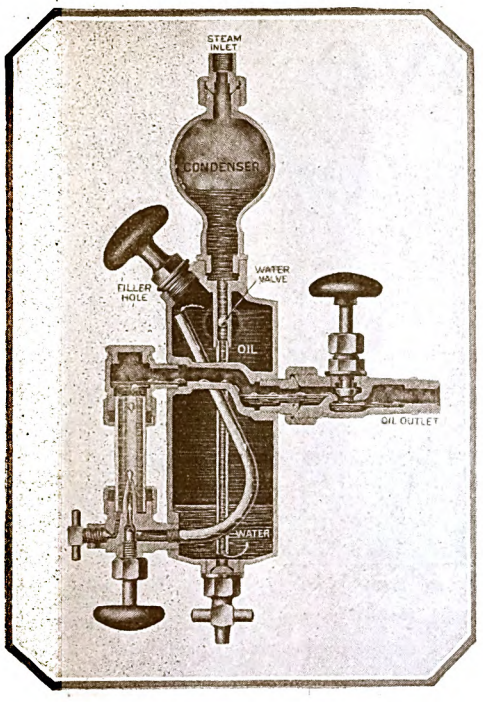
the entry of dust, dirt or metallic particles which would score the bearings.

The development of the sight feed oil cup rapidly followed. This device was a vast improvement over the waste pad method of lubrication, and eliminated the necessity for almost constant attention by the oiler. As long as it was kept properly filled and cleaned, a uniform and economical supply of oil was insured, and the flow could be stopped whenever desired by simply dropping a lever attached to the top. Sight feed oil cups are today a most important piece of lubricating equipment and are extensively used in the smaller plant, and on all such bearings where equipment with a circulating oiling system would be too expensive. They are usually built from one to five inches in diameter, from two to ten inches high, and up to one quart in capacity.



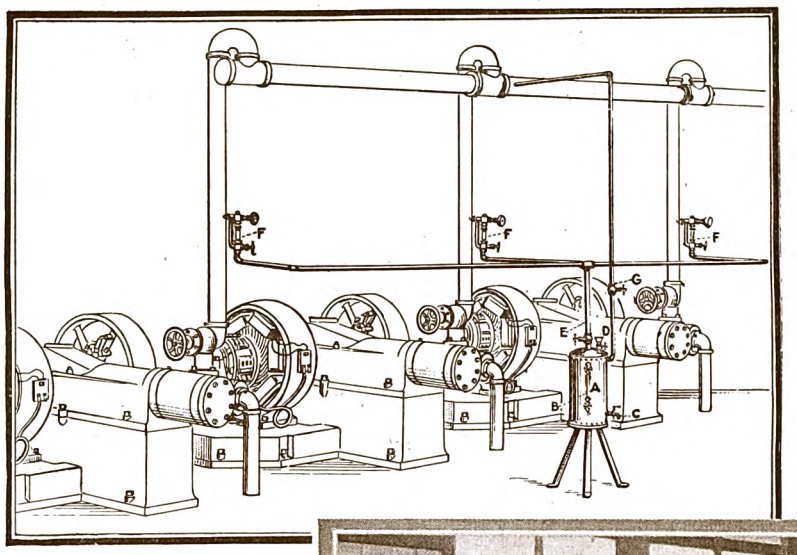
Type of Motor Driven positive feed grease lubricator designed for forcing grease to submerged bearings on pump and vertical water wheels.

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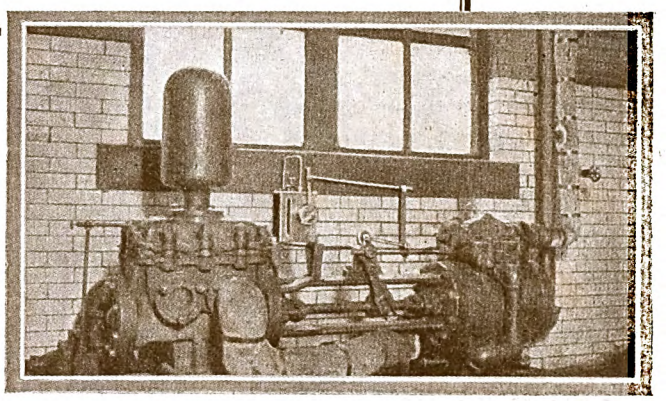


Sectional view of a hydrostatic lubricator showing the details of construction and the functions of the steam, water and oil. This lubricator operates by virtue of the body of water in the condenser "B" forcing the oil out of the oil reservoir into the steam pipe.

At the right—Illustration of a central tank, multiple feed cylinder lubricating system. Independent lubricators are shown at "F." The oil tank "B" is connected to oil and steam piping through valves "E" and "G" respectively.



Showing the manner in which mechanical force feed lubrication can be applied to steam cylinders of a steam pump, using a one quart Lubricator.

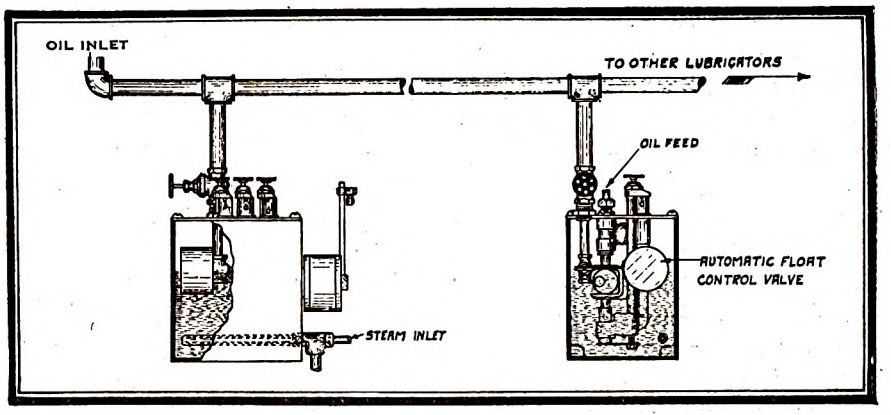


There are, however, many bearings in practically every installation where oil cups or circulating systems are not adaptable, owing to difficulty of access without stopping certain of the machinery, their natural location, and the need for a cheap installation. To overcome these difficulties the compression grease cup has come into usage. The great advantage of the latter is that it will furnish lubrication for an extended period of time without refilling, and requires only a periodic turn or two of the thumb screw to keep a thread of lubricant in contact with the bearing.

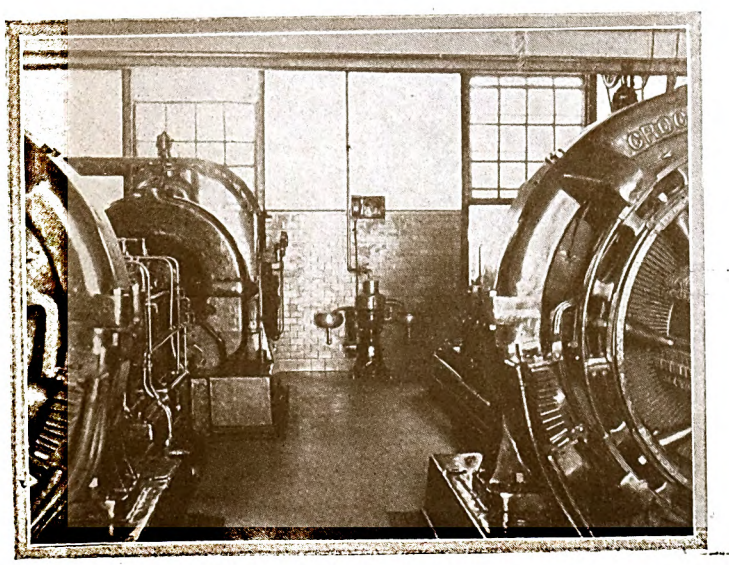
Owing to the fact that oil cups were found to require an appreciable amount of time and labor for filling, a large box

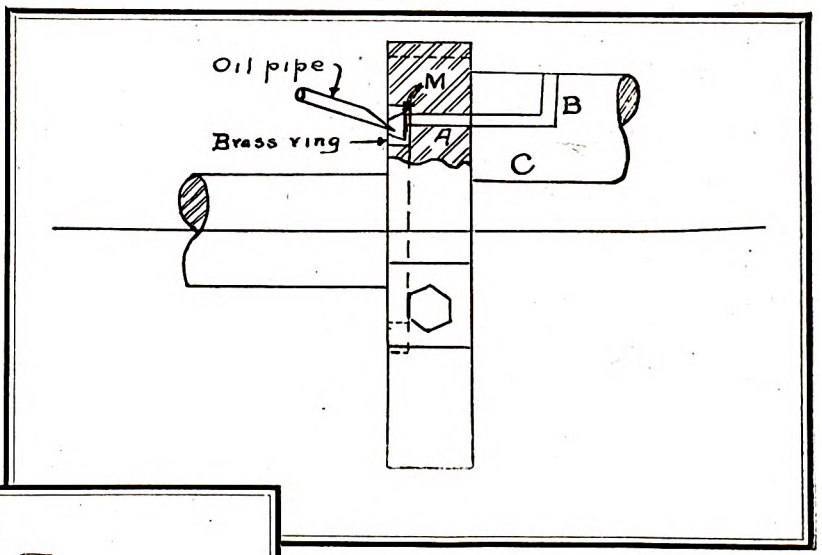
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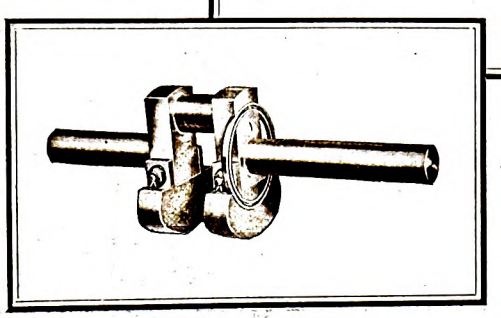
Sectional view of lubricators with inlet float control valves and heating connection, supplied from a central storage reservoir.



Below—Oil Purifier, of the same type as shown on page 22.







Centrifugal oiling device, in which a brass ring is securely embedded in the crank-shaft web. Oil is supplied through suitable piping. Centrifugal force causes oil to collect at outer edge of ring, building up a pressure proportional to the speed of shaft.

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Managing the Move

Getting Into the New Quarters with Least Confusion

BY W. H. LEFFINGWELL

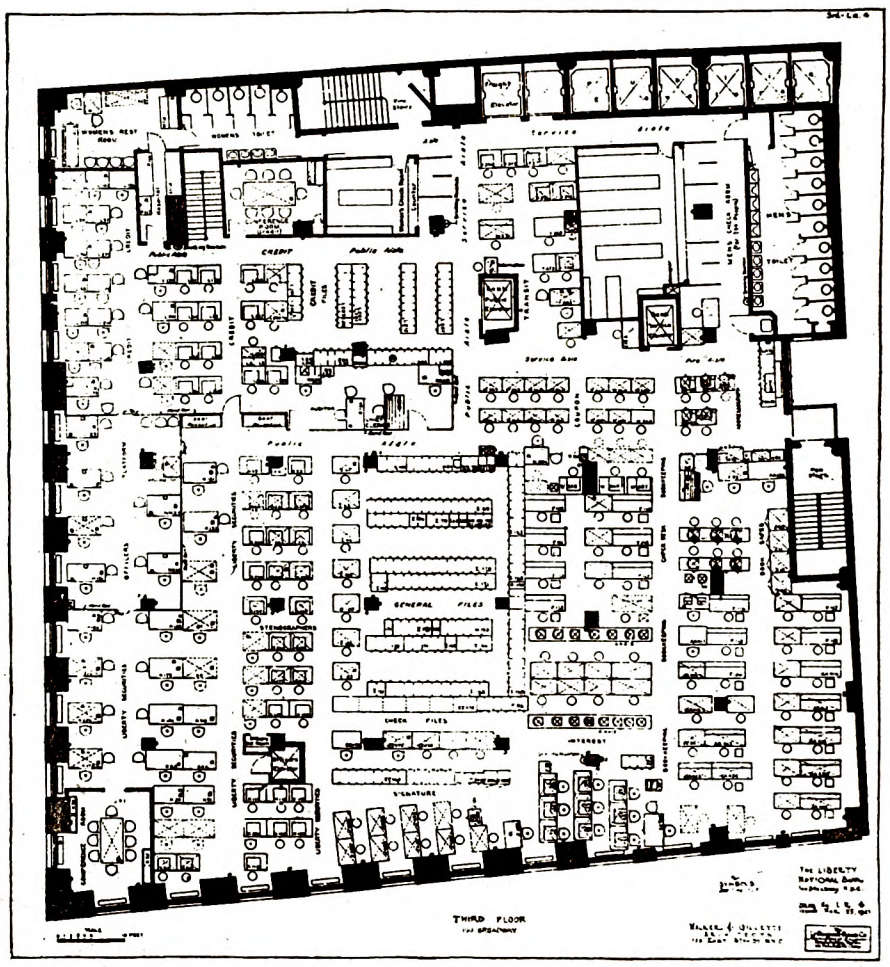
THREE moves are as bad as a fire, according to the old adage. It is pretty close to the literal truth too, judging by the usual experience of the American business house when it has to handle the problem of moving.

I witnessed an experience in Chicago recently. A large concern moved its general offices several blocks down the street to new quarters. In the process it lost several valuable papers. The wind blew them out of the drawers of desks, or they fell by the wayside; in any event, they were lost as completely as though fire had burned them. The move was made on Saturday so as to disturb business as little as possible, and by midnight everything had been transported to the new offices. But all next week the new offices were in a state of confusion, business was conducted under difficulties, and the greater part of the office force, instead of being occupied with their regular tasks, were busy shifting desks and files, getting the arrangement that suited the individual occupants, rearranging and sorting papers, and bringing some order out of the chaos —just the sort of thing that would be done after a fire.

But it is not necessary to do the thing this way. Some recent efforts have proved that the principles of scientific management can be applied to the problem of moving just as purposefully and successfully as they have been applied to the problem of production; and the move can be managed smoothly, without loss of time or property or interruption of business, and with an actual saving of expense.

A city bank was planning to move and asked a responsible moving company to quote a price for the job. The movers fixed their fee at $6,000. A hasty calculation showed that the number of pieces to be moved was six hundred, an average of $10 per piece. That seemed exorbitant, so we called on ten companies to bid, and finally a bid of $2,900 was received. Even that seemed too high, but in the absence of any scientific standards on moving we decided to accept it and time-study the job. The studies were made by elements. For example, the length of time to lift a desk; the number of people required to lift it; the length of time to carry it a certain number of feet to the elevator; the length of time required to place it on the elevator; and so on. Figures

(*Continued on page 45*)



In moving to new quarters, such a detailed layout as the above reduces the actual moving to a smooth-running, automatic process—everything going to its proper location without a hitch.



The original arrangement of stock floor of a wholesale house. Compare this with the illustration at the extreme right, showing how rearrangement was effected.

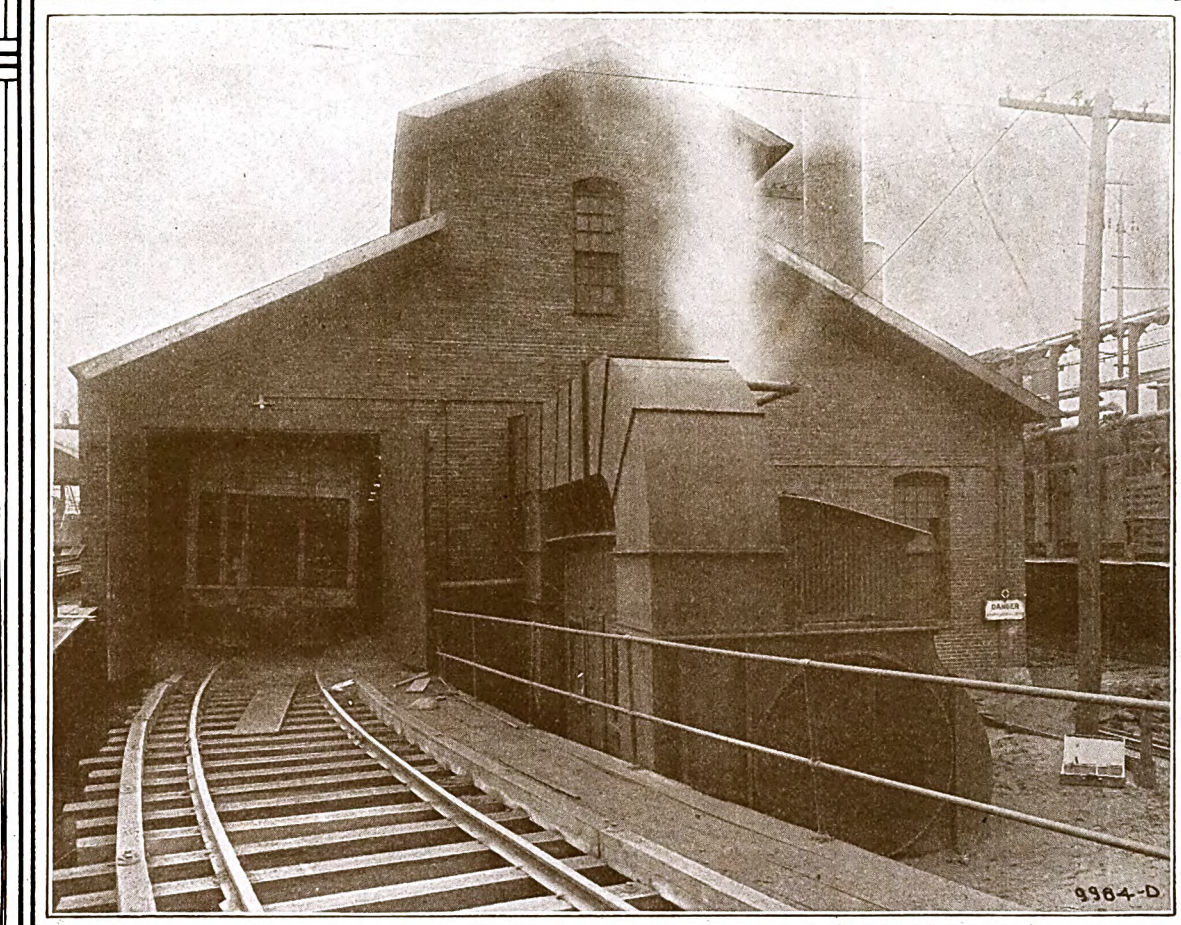
Below—In preparing to move, see all papers, etc. are tied in bundles; not left loose where they may be lost.

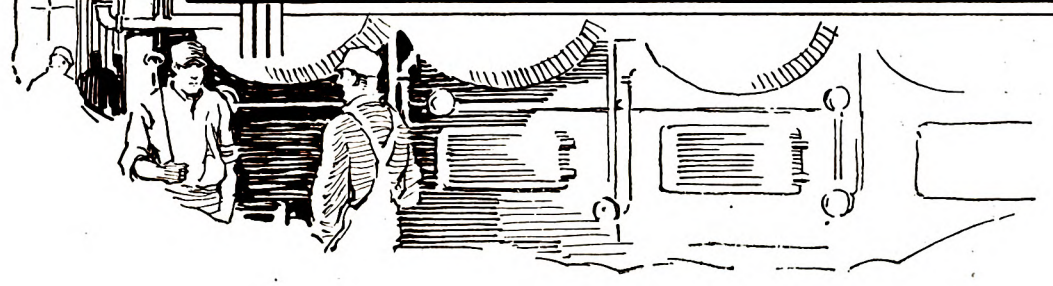




Same stock floor, as shown at the extreme left of this page, rearranged to facilitate the work and economize.

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Installation of American Blower Mechanical Draft equipment at the plant of the By-Products Coke Corporation, Chicago.

American Blower Mechanical Draft Saves $88,200 a Year

A Letter From the By-Products Coke Corporation of Chicago

"When we added 2 units to our auxiliary boiler house, in 1911, we installed an American Blower forced draft system. This consists of 2 steam driven fans, one being used as a spare. At present, this equipment supplies air to 6-400 H. P. hand fired boilers, and because of the excellent draft we can burn fine coke brieze very satisfactorily.

To get the same capacity with natural draft, we would have to burn coal, which costs $3.50 a ton more than fine coke brieze. Therefore, the American Blower system saves $88,200 a year in fuel cost. It also saved the cost of the higher stacks which would probably have been required to create satisfactory natural draft.

We are also using 4 American Blower fans for handling hot gases from our coke ovens. This enables us to generate 1000 boiler horse power for every pair of fans.

The American Blower equipment was chosen because we were convinced that it would give good service. It has been very satisfactory and we have experienced no mechanical troubles. Under similar conditions we would repeat our orders.

The manufacturers furnish first class service, a highly important consideration in the choice of any equipment."

Bulletins describing American Blower equipment will be mailed upon request.

AMERICAN BLOWER COMPANY, DETROIT
BRANCHES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO (261)

American Blower

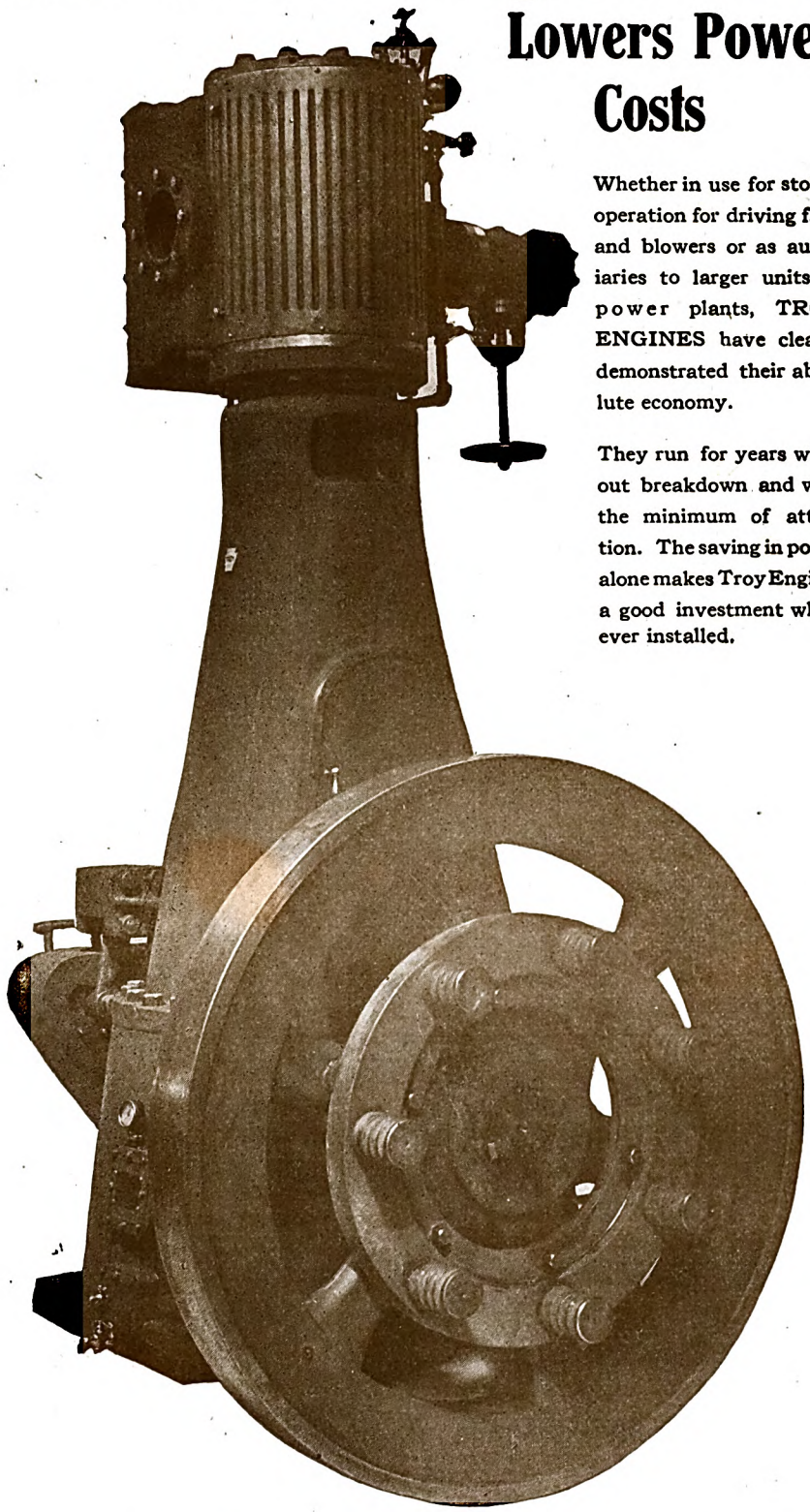
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The Small Engine that Lowers Power Costs



Whether in use for stoker operation for driving fans and blowers or as auxiliaries to larger units in power plants, TROY ENGINES have clearly demonstrated their absolute economy.

They run for years without breakdown and with the minimum of attention. The saving in power alone makes Troy Engines a good investment wherever installed.

The Balanced Valve is an exclusive Troy feature. The cylinder is automatically cleared of condensation. The packing ring is steam-tight and remains steam tight even under extreme conditions.

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TROY ENGINE & MACHINE CO.

TROY, PENNSYLVANIA

Built in sizes 2 to 200 B.H.P.

Vertical, Horizontal, Belted and Direct-Connected.

TROY ONLY STEAM ENGINES GOOD ENGINES ONLY ENGINES

The Preparation and Burning of Pulverized Coal

(*Continued from page 20*)

generation, have only emphasized and confirmed the success of those fearless pioneers in the Engineering field who dared to blaze the trail for powdered fuel: experimenting, designing, discarding, re-building, spending hundreds of sleepless nights and thousands of hopeful backers' dollars, improving and more nearly perfecting machines and equipment to fulfill the sub-title of this article "Cut the Coal Bill!"

The fine art of pulverizing coal is not new. It has been done for years, and there are "mills" of every description —roller mills, ball mills, tube mills, and ring-roller mills— each type with its adherents and antagonists, each performing its function, and each with its own little brood of troubles —successfully reducing lump coal to powder. No engineer denies that coal can be pulverized, and that, *practically;* but the discussion starts with the system of distribution, or method of application. There are two methods of application: *direct,* with pulverizing equipment located immediately adjacent to the point of consumption; and *indirect,* with all pulverizing equipment grouped in a central station or plant, distributing the prepared fuel to various points of consumption— the latter sometimes scattered in several directions, and located hundreds of feet apart. For the indirect method of firing, there are three systems of Distribution: (1) mechanical conveyors, usually of the "screw" type, (2) high-pressure air, and (3) volume air at low pressure. Summarily, screw conveyors are costly to install, and more costly to maintain and operate. High-pressure air is costly, both from the standpoint of first cost and operation. Volume air at low pressure requires more power to operate, but has low first cost and low maintenance. This article holds no brief for any method or system —the fact stands undenied, that each and all are *cutting the coal bill,* but the one that cuts the deepest is the method and system which (regardless of first cost) will effect the greatest general efficiency throughout the plant wherein it is installed, at lowest cost spread over an operating period of five or ten years.

Having reached the conclusion that bituminous coal can be practically pulverized and distributed to various points of consumption, by one of the several systems now in general use, our thought naturally turns to the adaptability of pulverized fuel for firing, seeking to find the largest consumers, and, from the standpoint of national economics, to ascertain where the greatest savings can be effected. Assuming the amount of coal mined in the United States in one year to be an average of 600,000,000 tons, we find:

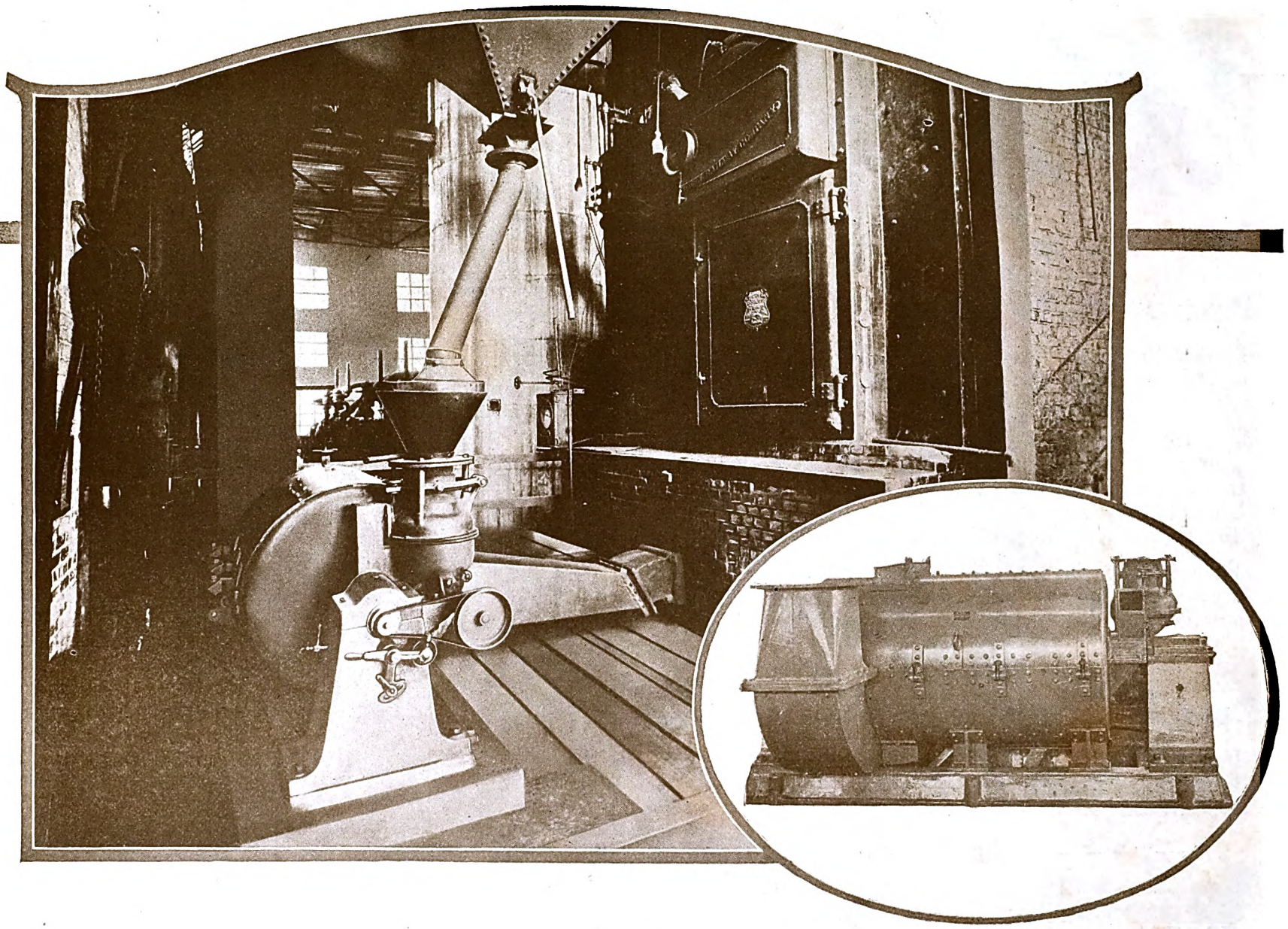
(1) 75,000,000 tons used for producing coke
(2) 100,000,000 tons used in domestic establishments
(3) 100,000,000 tons used by ships or exported
(4) 150,000,000 tons used by railroads
(5) 175,000,000 tons used in power plants, large and small.

Passing, for the moment, items 1, 2 and 3, we find the largest consumers in commerce and industry, to be the railroads and power plants. The loss and waste in the former—the backbone of our National Industry—is enormous, and pages could well be devoted to the possible economies there, but space will not permit the review of progress made in pulverized fuel firing under locomotive boilers. Suffice it to say, in passing, that actual accomplishments along this line have progressed beyond the experimental stage, a number of prominent Trunk Lines have locomotives thus equipped in practical operation, and indications point to the ultimate general use. The exceptions will be those roads whose lines operate through established oil fields, where fuel-oil becomes the logical and economical answer to the locomotive-firing question.

Thus, by elimination, the problem remaining for particular consideration in this article, is "cutting the coal bill" for the 175,000,000 tons consumed industrially in the

(*Continued on page 30*)

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A Compact Powdered Coal Equipment

The Aero Unit System Delivers Coal in Powdered Form Direct to Furnace Under Precise Control—

"Greater Efficiency, Mechanical Simplicity and Ease of Control justify the change that has been made in the plant by substituting pulverizing coal equipment for stoker equipment;" writes an engineer in his report of a test on the Aero Unit System of Powdered Coal.

The installation demonstrates how an original idea of simplified equipment is finally perfected to meet the most exacting requirements and insure thoroughly dependable operation.

The Aero Unit receives the raw coal from the bunker, without preliminary drying, and exhausts it in the powdered form direct to the furnace. There is no storage of the pulverized coal. Control of coal and air is positive and can be instantly regulated to meet the varying conditions.

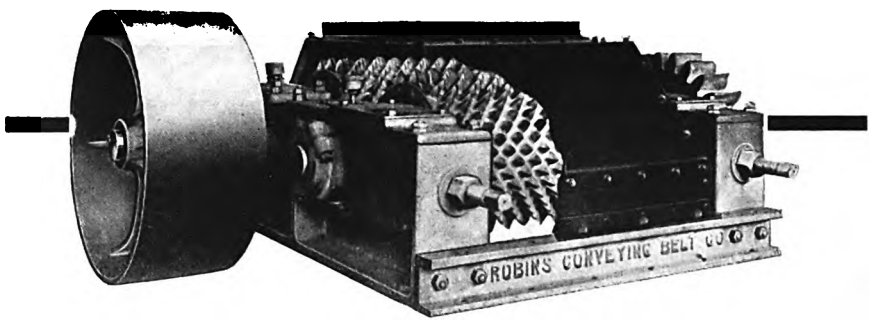
The heavy steel construction has been developed on the basis of long experience to meet the contingencies in service.

Send for Bulletin No. 28.

Aero Pulverizer Company,
165 Broadway, New York.

AERO UNIT SYSTEM

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Robins Standard Two-Roll Crushers

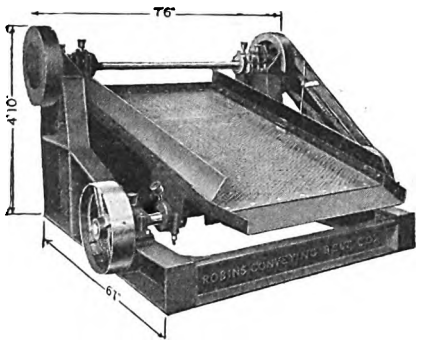
Massively constructed, with interchangeable parts that are "get-at-able," appeal to the practical man familiar with the trouble and expense of ordinary crushers.

The rolls are composed of chilled cast iron toothed segments for coal and fluted segments for coke, attached to roll hubs by steel bolts. The bearings are heavily babbitted, split on 45 degrees thus placing the thrust directly on the center rather than on the edges.

The rear bearings rest against a standard railway draw-bar spring to allow of the roll giving way in case any foreign substance finds its way into the crusher.

Robins Coal Preparation Equipment

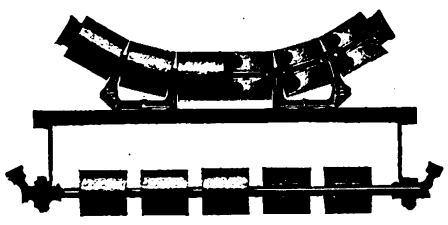
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"GRASSHOPPER" SHAKING SCREEN for coal and coke. Capacity up to 150 tons per hour with 5 H. P. motor. This screen will give three sizes when furnished with a double deck. Over 100 in successful operation.

Our Engineering Department

is ready to co-operate with you in the design of coal preparation equipment for Power Plants, Gas Works, By-Product Plants and Industrial Power Plants.



Robins Standard 5-Pulley Idlers

in all sizes from 12 in. to 60 inches. All pulleys in same vertical plane. Friction and roller bearing types with grease cups or "Alemite" fittings.

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Please send information describing Robins Coal Preparation Machinery and other ROBINS PRODUCTS.

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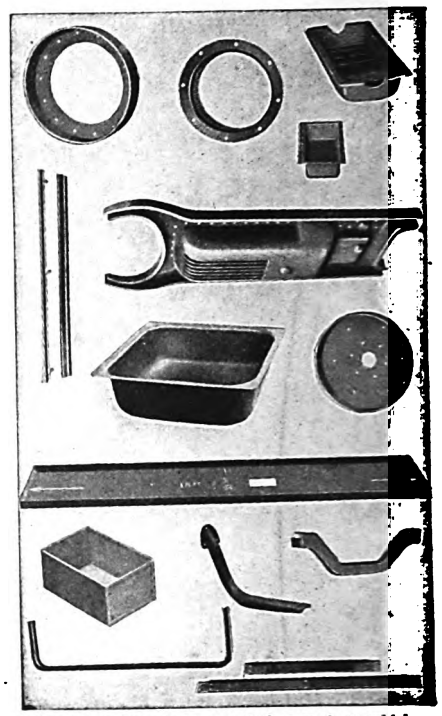
(*Continued from page 28*)

United States each year. If any doubt remains, in the mind of the reader, about the trend of the times (as far as pulverized coal firing is concerned), let him reflect on the following noteworthy installations which have been operating with unqualified success, from two to six years. The last named is now in course of construction. Ford Motor Co., River Rouge, Detroit; Milwaukee Electric Railway & Light Co., Oneida Street and Lakeside stations; Bethlehem Steel Co., Lebanon, Pa.; M. K. & T. R. R. Co., Parsons, Kansas; Puget Sound Traction Light & Power Co., Seattle, Wash.; United Verde Extension Mines, Arizona; Nevada Consolidated Copper Co.; M. A. Hanna & Co., Lytle, Pa.; General Electric Co., Schenectady, N. Y.; Carnegie Steel Co., Homestead, Pa.; British Columbia Sugar Refining Co., Vancouver, BC. or the new 350,000 KW station of the Union Electric Light & Power Co., St. Louis, Mo. Cahokia Power House.

We must conclude then that pulverized coal firing has proved, beyond the peradventure of a doubt, its efficiency and economy in the *large* central station. But, numerically, these stations are in the overwhelmed minority, and therefore cannot be considered as extravagant wasters of fuel. The small, inefficient, and comparatively high-cost plants, scattered throughout the country, are decidedly in the majority, and should receive our attention. Strangely enough the general impression seems to be that pulverized firing is not practical in plants developing less than 2000 hp. As a matter of fact, this impression is far from a correct and logical one, for it is among these so-called "isolated" plants that will be found the *greatest* need for immediate and permanent economies. The average boiler plant, under 2000 hp normal rating, requires an average of 7 pounds of coal per hp hour, and the cost of coal, plus labor for firing and disposal of ashes, comprise 80 per cent of the total cost of $120 per hp. year. The use of pulverized coal will cut these costs in two. Operators of small plants should know they do not need

(*Continued on page 33*)

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A few examples of pressed steel stampings which we have made for prominent companies

YOU will find our equipment for making pressed steel stampings unsurpassed in completeness. We have presses and machines of all kinds, capable of very heavy pressed steel plate work as well as the lighter sheet metal stampings. Our facilities for electric welding are unusually large, including best modern methods. We have complete machine shops for making dies, tools, etc.

Among our products are Truscon Alloy Steel Platforms and Boxes, Conveyor Parts, Truscon Alloy Steel Flasks, Bottom Boards, Core Plates, Core Racks, Gaggers, Ladles, etc., etc. Truscon Alloy Steel Products for foundries and for handling material are sturdy, durable and economical.

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Our engineering force is always at your disposal. In designing your steel parts its advice and co-operation can save you money or give you a better product. The long experience of the Truscon organization will also be of value to you in improving your products by using pressed steel in place of other materials.

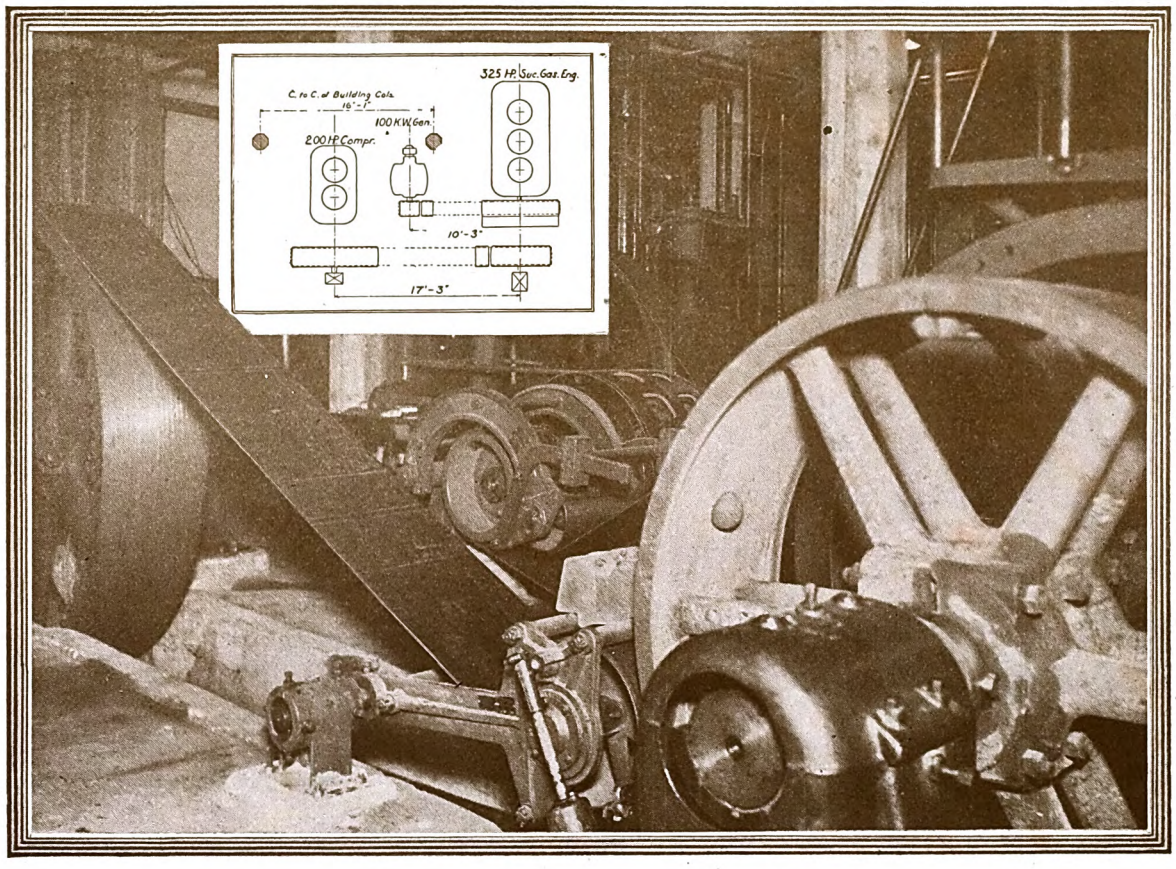
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TRUSCON ALLOY STEEL PLATFORMS

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Another Example of the Advantages of The LENIX DRIVE

The LENIX Drive has solved the problem of this company of co-ordinating a compressor and a 100 KW generator with a 325 HP suction gas engine. The centers are 17′ and 10′ respectively. Thirty feet centers would be required with ordinary open belt drives. Three of such combination units, as illustrated, are installed and operating.

In addition, in the same plant, there is one LENIX on a 400 HP suction gas engine driven compressor and one LENIX on a 60 HP motor driven compressor.

The special design of these LENIXES automatically adjusts itself to all the irregularities in starting the suction gas engines.

The varying power requirements of the compressor and generator may cause one belt to stretch more than the other. The LENIX compensates for the uneven stretch of the belts by automatically taking up the slack and utilizing it to increase the arc of contact between the belt and pulleys, thereby bringing into working contact the hitherto unused surfaces of the belt and pulleys.

Wherever belts are used in power transmission, the LENIX will improve your drive

Booklet "Saving Slippage and Space" describes the LENIX. A copy will be sent on request.

Five Points

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains, constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

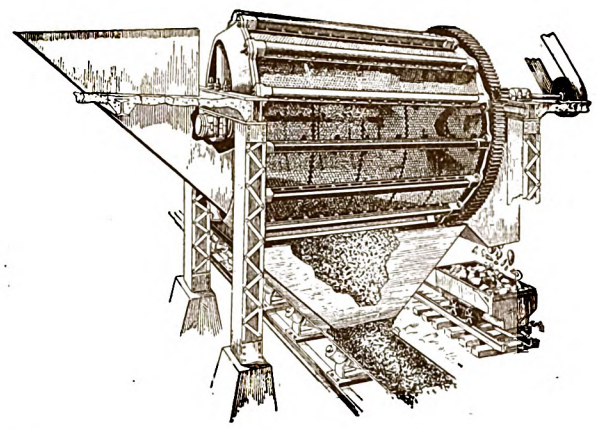
5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

F. L. SMIDTH & COMPANY
ENGINEERS
50 Church Street, New York, N. Y.

The LENIX DRIVE

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Preparing R. O. M. Coal *for* Pulverizing



"Pennsylvania" Bradford Coal Breaker and Cleaner

The "Pennsylvania" Bradford Breaker prepares R. O. M. Bituminous Coal for Stokers, Gas Making, Washing, Coking and for Pulverization.

The crushing is done by the simplest and most elemental method of raising and dropping the coal repeatedly. During the course of this process the good coal breaks and passes the screen plate perforations with minimum fines, and accurately sized for the particular purpose for which it is being prepared, while the harder refuse including slate, bone, sulphur balls, Tramp Iron, wood, binder and stone is automatically ejected, as shown in the cut below.

"Pennsylvania" Coal Preparation Machinery also includes Steel-built Hammer Crushers for finer reductions, and Single Roll Crushers for smaller installations.

All of this equipment is arranged either to eliminate the Tramp Iron, or to operate without damage and breakdowns from Tramp Iron.



The resulting product is accurately prepared for pulverization either directly following the crushing operation or after drying.

A "Pennsylvania" Bradford Breaker is included in the equipment of the largest Central Station designed for operating on pulverized fuel, and will prepare 300 tons of Bituminous Coal hourly in this service.

The automatic elimination of Tramp Iron protects the pulverizing equipment, preventing costly breakdowns and delays.

We have brought the right solution to many coal preparation problems, and are ready to cooperate on receipt of your suggestion.

Send for Bulletin 6001

PENNSYLVANIA CRUSHER COMPANY

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PHILADELPHIA, PA.

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The best equipped plants have the best efficiencies.

Every Power Plant Chief Wants His Men Protected

Not one would let the cost of a safeguard stand in the way where the safety of the men in the plant is concerned. And yet in many instances safeguards are installed too late—after an accident occurs.

ACT NOW

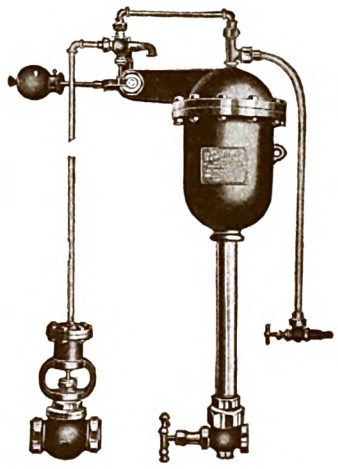
You will be safeguarded against boiler explosion due to low water if you use Vigilant Regulators.

They cannot fail to operate and keep the water level where it will enable the boiler to produce the driest steam at the highest economy figures.

The slow uniform feeding of these Vigilant Regulators means fuel economy because the feed water is then heated uniformly to a higher degree. Their operation depends on gravity—always positive. No expansion tubes to buckle or to get out of line. No diaphragms to crack. No floats to fail. You can actually see it work. The movement of the outside weighted levers gives evidence of its operation.

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VIGILANT Feed Water Regulator



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The Chaplin Fulton Mfg. Co.
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POWELL VALVES

Backed by 75 Years Experience

Powell Triple Acting Valves automatically close when a tube bursts —isolating the boiler.

POWELL WHITE STAR VALVES

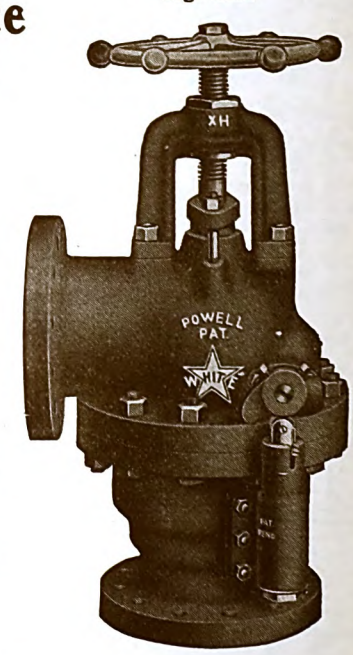
are a combination of the most serviceable mechanical factors insuring to the user unfailing dependability.

Two reasons for their long life are their regrindable, renewable disc, both cast of Non-Corrosive Powellium Nickel.

Medium and extra heavy for steam working pressure up to 200 and 300 pounds.

SEND FOR DESCRIPTIVE CIRCULAR

Fig. 2228



The Wm. Powell Co.

2525 SPRING GROVE AVENUE CINCINNATI, OHIO

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(*Continued from page 30*)

to buy a Packard, when the price of a Ford, only, stands between them and efficient economy.

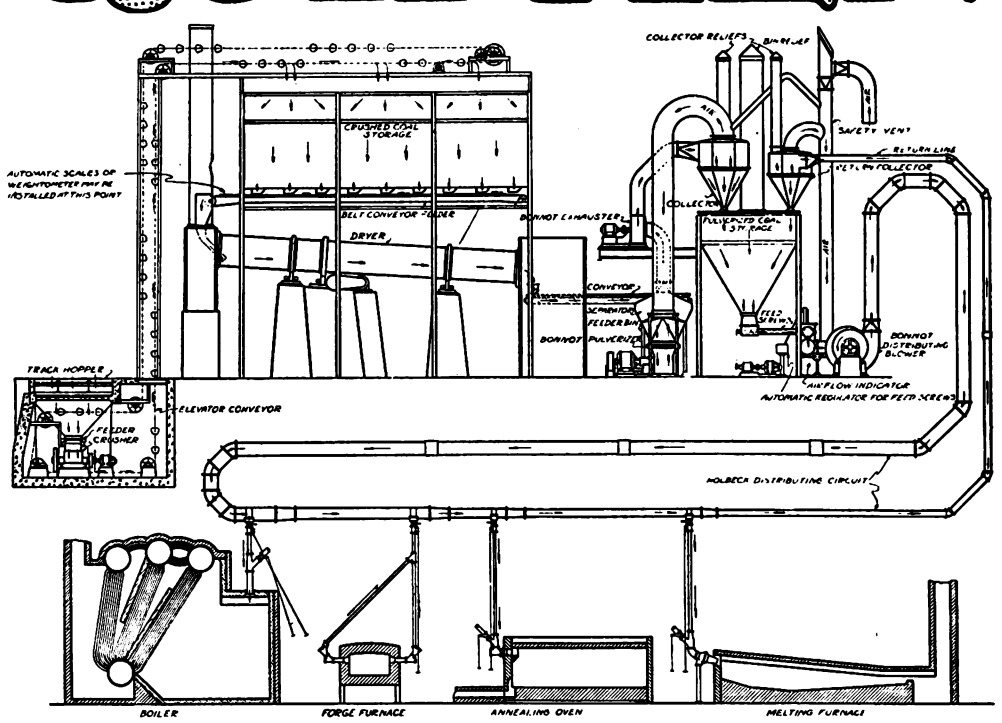
There have been several popular reasons (or alibis!) for the unpopularity of pulverized coal in those smaller plants. The first cost "bug-a-boo" has loomed over the horizon in numerous instances, but a careful investigation will prove this a myth of chimerical nature—dissolved into blue air—you will find that economies in the smaller stations are not only possible *but can be proven.* Do not be frightened by the seemingly prohibitive costs of fuel installations in large central stations. Modern methods, and progress made by engineers who are specialists in combustion and preparation of fuels for combustion, have developed mechanical equipment for all conditions—the small consumer may now obtain apparatus suitable for his needs, at a first-cost ridiculously low when compared with the savings effected. Some manufacturers even go so far as to *guarantee* certain savings, basing their assurances upon actual costs, of record prior to the adoption of pulverized firing to supersede hand-fired or mechanical stoker operations. Therefore, the element of chance has been practically eliminated for the prospective investor in or user of pulverized fuel, either in the power-house boiler, or in the furnace of the metallurgical industry.

Another goblin of fright has been proven imaginary also—the fear of explosions when handling pulverized fuel. The use of the descriptive adjective "powdered" in conjunction with "fuel" should be discontinued as a misnomer, lest the suspicious and doubting ones fail to rid themselves of the idea that "pulverized coal" is synonymous with "gunpowder." Truly enough, accidents *have* happened in plants where pulverized coal was burned—but have there not been boiler explosions, gas explosions, and oil explosions? Happily, these are rare occurrences nowadays, having become so through the efforts of the Federal Bureau of Mines, whose investigations have resulted in the broadcasting of invaluable "*don'ts*" and "*do's*" across the widespread fields of industry. Pulverized coal can be and *is being* burned with no more diastrous results than from the use of steam, gas, or fuel oil. Carefully kept records of the largest industrial corporations in the United States are the authority for this statement.

The illustrations which accompany this article, show clearly the details of equipment in typical pulverized coal installations, and are impressive in that they show conclusively, the wide range of apparatus. Scarcely a branch of the industrial tree, but can be reached by pulverized fuel, with equipment that "cuts the coal bill."

Coal has been called "Black Diamonds" but in Anno Domini, 1923, there is more truth than jest in the appellation. Diamonds are precious because they are admittedly a luxury, to be purchased only by men of means; they are luxurious because they are expensive, to be owned by Queens; one of the governing reasons why they are expensive, is because only a small proportion is actually recovered and used, in the process of making them valuable.

PULVERIZED COAL EQUIPMENT



Diagrammatic Arrangement of The HOLBECK PULVERIZED COAL SYSTEM showing adaptability to Boiler, Heating Furnace, Annealing Oven or Melting Furnace

We design, build and install, complete coal handling and pulverizing systems, from railroad car or coal barge to boiler, furnace or oven. We have equipped some of the most noteworthy plants in the United States and abroad—our Engineers will study your problems, submit designs and estimates, without obligation on your part. On our reputation, we solicit your inquiries.

The Bonnot Company

Canton, Ohio.

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Automatic Lubrication

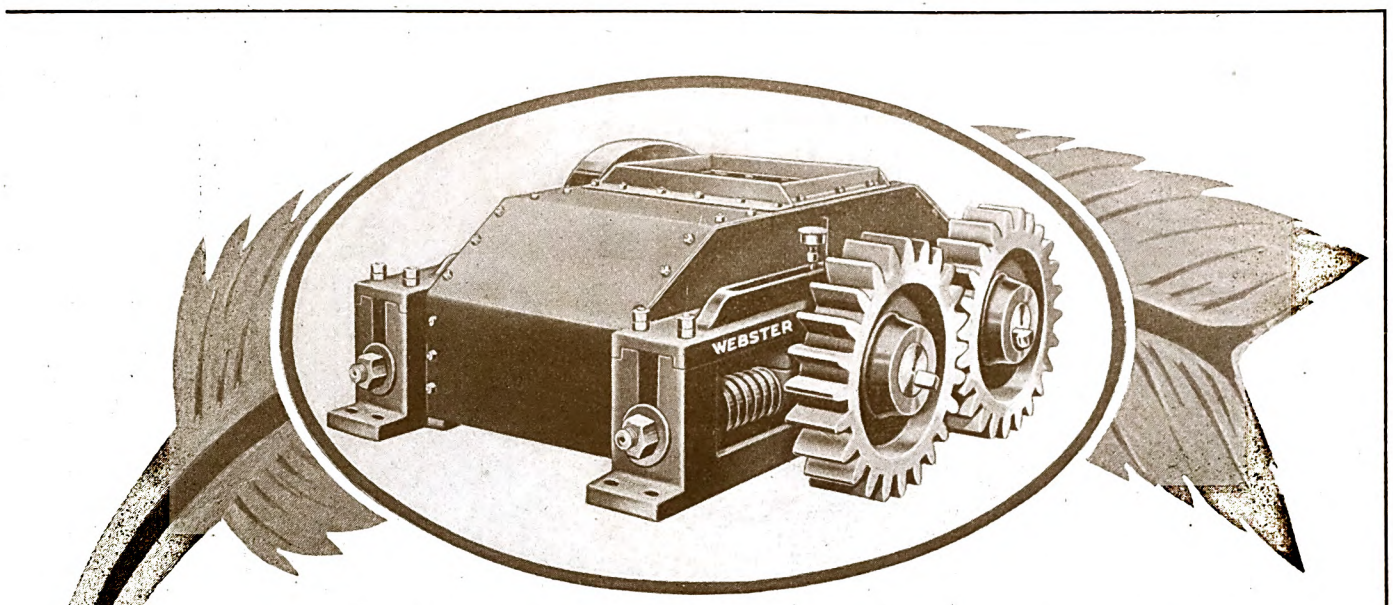
(*Continued from page 25*)

or manifold, of several gallons capacity, was introduced as a central source of oil supply for the system. As installed today, such a manifold is located upon the machine to be lubricated, being set slightly higher than the topmost bearing served. The bottom of this manifold is equipped with suitable valves and sight feed connections to the piping which leads to the various bearings. Thus, the oil supply to each can be regulated or cut off independently from the others. The great advantages of such equipment are: The viscosity of the oil is relatively little affected by temperature changes; filling, cleaning and adjustment can be carried out far more rapidly than were individual oil cups used; and oil pipes can be lead to bearings which would be practically impossible for the operator to reach without shutting down the machine.

With the necessity for the re-use of lubricating oils becoming a paramount factor in power plant operation, ring and chain oiled bearings soon came into development. Today this construction is extensively prevalent on all types of high grade equipment such as motors, centrifugal pumps, etc. In basic form the ring or chain oiled bearing is separated into two parts by a slot in which revolves a metal ring or chain which is hung on the shaft. The bottom of the bearing box is cast with an oil reservoir into which the ring or chain is suspended. Thus, with the revolution of the shaft the ring or chain is given a certain amount of rotation to carry the oil to the top of the bearing from whence it flows into the clearance space or oil groove. It is thus distributed to the entire surface of the shaft and bearing, to flow therefrom back to the oil reservoir.

Lubrication by means of ring or chain oilers is the simplest form of what is looked upon today as the most efficient method of oiling, *i. e.*, to flood the bearings with a large excess of oil over the quantity that would normally be absolutely necessary for proper lubrication. Thus the oil not only serves to lubricate, but as well, it acts as a cooling medium and reduces the operating temperature by carrying away a certain amount of frictional heat which is ultimately radiated to the air from the exterior surface of the oil reservoir. For this reason the latter should have quite a large capacity. Another advantage of this method of continuous oiling is, that the flood of lubricant tends to wash the bearing surfaces clear of metallic particles, dust and dirt, and consequently wear is reduced to a minimum. Due to this washing action the oil in the reservoir will gradually become impure. For this reason ring and chain oiling systems should be flushed out and cleaned periodically, and refilled with new or purified oil, otherwise

(*Continued on page 38*)

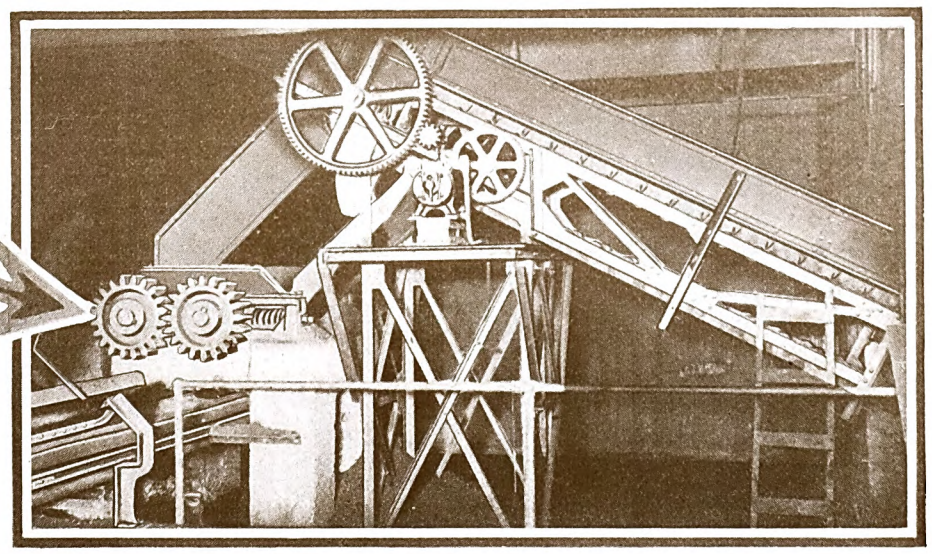


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will insure a regular supply of properly sized coal for your automatic stokers at a low cost per ton.

They are built in single and double roll types, in capacities to handle 30 to 200 tons per hour.

Shall we send you our catalog showing our various types and sizes of coal crushers?

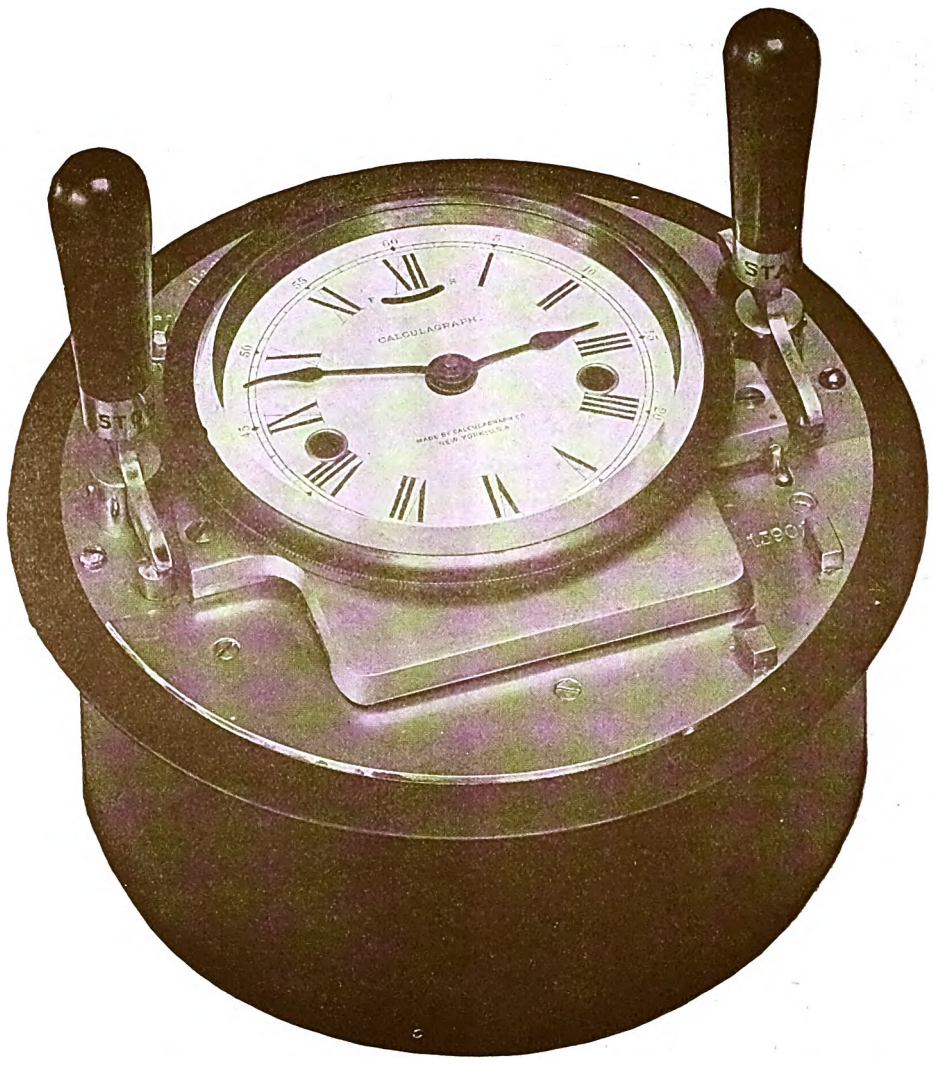


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elapsed time recorder

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Each Calculagraph is a separate unit. Any number of men can use one Calculagraph, but if you have several departments, or different floors, as many can be installed as desired.

Not only are mechanical difficulties avoided but human errors lessened. The time of cost clerks is saved. They no longer need to subtract starting from stopping time. The *elapsed time* can be read direct from the job ticket.

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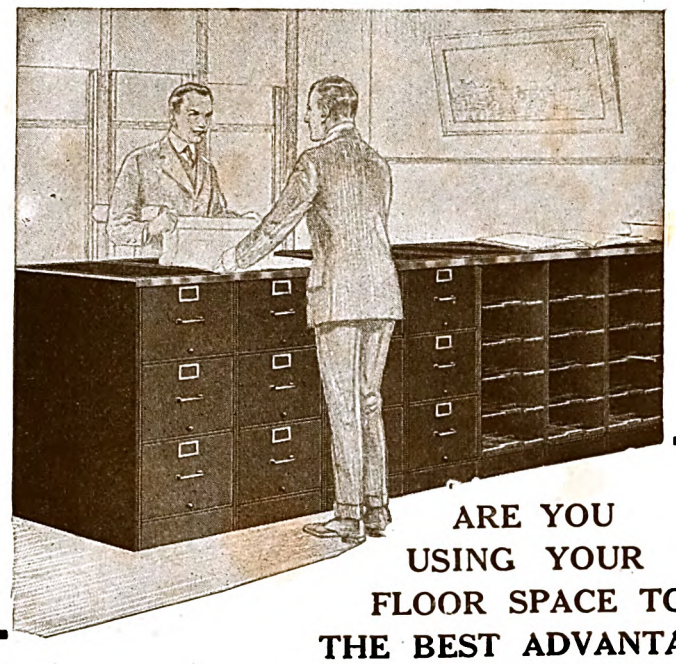
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THE ELAPSED TIME RECORDER

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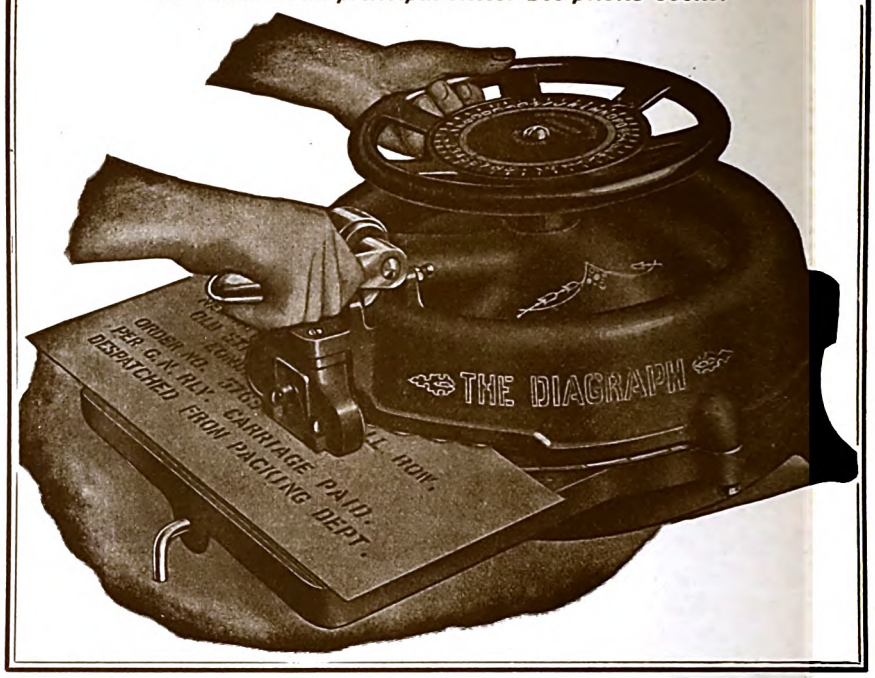
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The Diagraph cuts legible address stencils for marking all packages, boxes, bags, cans, crates, castings and similar material. Addresses do not blur, wash or rub off. Safer than tags. A practical insurance against lost and delayed shipments.

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THE RECTIGRAPH COMPANY manufactures its own photographic copying machines and coats its own photographic paper, the entire plant being devoted exclusively to this line. Due to a lowering of the prices of some materials and economies effected in our new plant, we are enabled to announce a reduction of 20% from the prices prevailing on photo-copying paper for some time past.

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8½-inch width	$10.68
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12¼ " "	15.45
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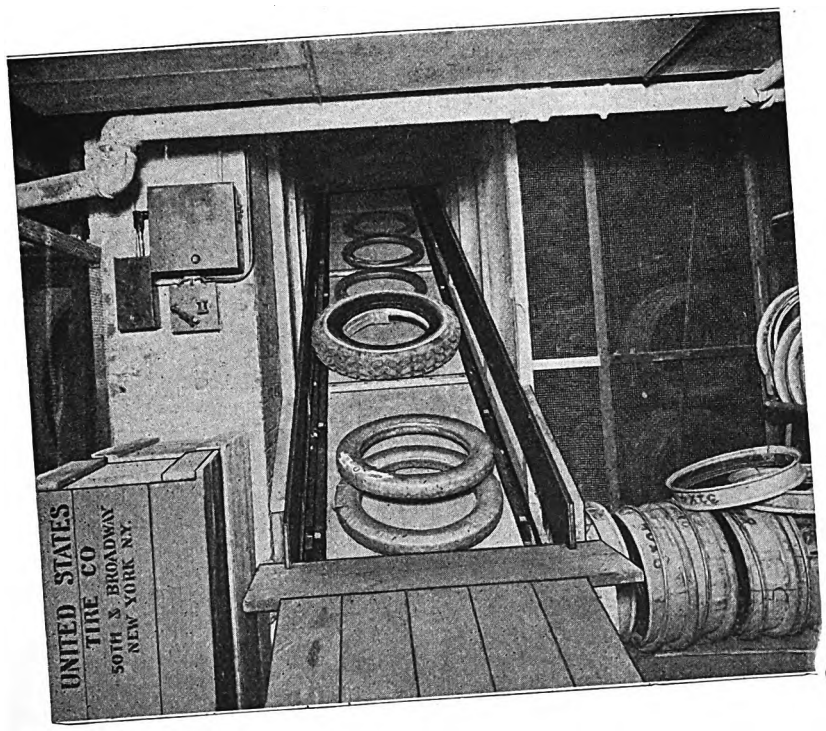
Rectigraph emulsions are coated upon a high grade 100% rag stock, producing excellent results with a durable base. Rectigraph paper is a contrasty bromide paper with excellent orthocromatic qualities, and will reproduce colors perfectly. All the speed consistent with good quality.

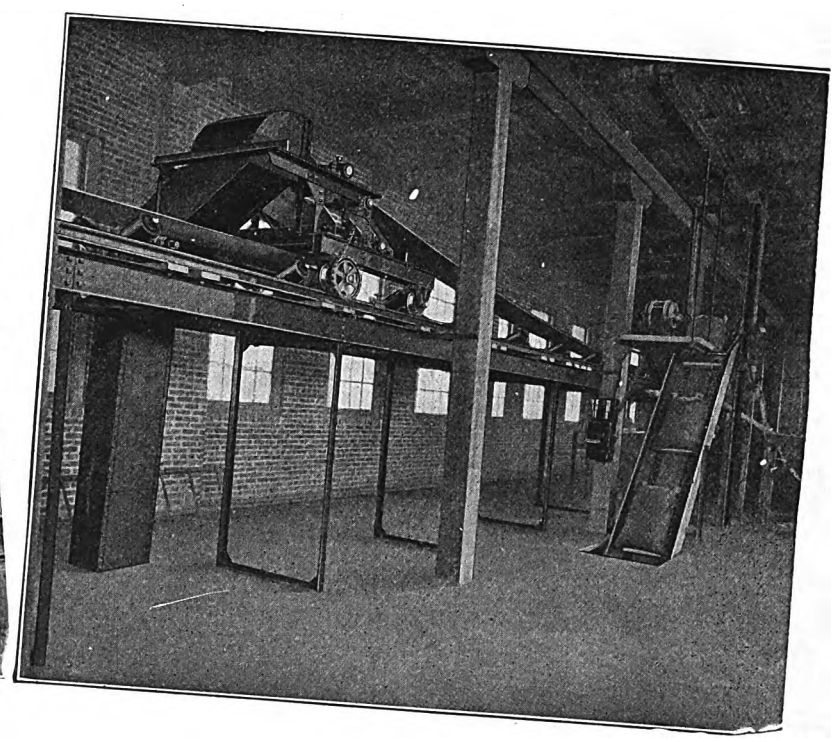
The RECTIGRAPH COMPANY has always regarded acceptance of an order as a pledge that it would be filled at the earliest possible date. The output of our plant belongs to our customers with orders on our books. This policy compelled us, during the past few years, to decline much desirable business which would have been highly appreciated, but this could not be considered without prejudice to previous connections. Improved facilities in our new plant enable us to increase production and quality and to decrease manufacturing costs. ***Our Customers will benefit.***

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Rectigraph Company
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How does your present production compare with that of a year or six months ago?

If your production remains about the same it is very likely that you are dis-satisfied with the status of your business. If this is the situation production should be increased because genuine prosperity is the result of maximum production—smaller unit profits and increased sales.

A Conveying System not only increases production but it is the means of controlling it. Your present equipment plus a Conveying System designed to meet your individual conditions will yield a production far in excess of that which you are producing at present.

Conveying Systems to function properly must be designed to meet specific requirements. This requires making a survey of your plant, studying your operations, determining desired production so that data can be secured which will enable us to design a conveying system which will enhance your production.

Adequate production will make your business prosperous. Lose no time. Communicate with us at once. Write us immediately advising time convenient to confer with our engineers.

SAMUEL OLSON & CO.

Loose, Bulk and Packed MATERIAL HANDLING SYSTEMS

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(Continued from page 34)

the excessive accumulation of foreign matter will be liable to cause scoring of the shaft and bearing metal.

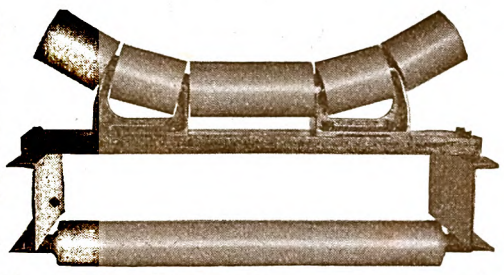
It is seen that flood lubrication is, therefore, directly opposite to the old theory of supplying wearing parts with just enough oil to properly lubricate them, or, in other words, the theory of drip cup and hand lubrication. Flood lubrication is admirably efficient but it should never be carried to a maximum unless the oil reservoir is of ample size to allow sufficient time for the oil to be properly cooled and cleaned. Otherwise there will be a marked tendency towards emulsification, oxidation and vaporization.

Of the force feed system in use today, the gravity feed idea is perhaps the simplest in construction. Essentially it is much similiar to the manifold principle of drip feed lubrication, though the reservoir is usually located at a greater elevation to simulate force feed or flood lubrication by virtue of the increase in head. In such a system the oil is recovered in the base of the machine, or in drip pans, and filtered before re-use.

The circulating gravity feed system differs from the simple gravity installation, in that the entire process is automatic, and the oil after filtration and purification is returned to the storage (or feed) reservoir by a suitable pump usually operated from the machine which is being served. Oil distribution to the bearings is in general, similar to the gravity feed principle, but after it has served its purpose it is pumped or run by gravity from the machine base into some form of purification device. From here it is pumped back to the storage reservoir for re-use.

Mechanical force feed lubrication is the most positive in supplying oil to the bearings, of any of the so-called automatic systems. As a general rule the oil is forced to the bearings at a pressure of from 5 to 15 pounds per square inch. No overhead storage tank is required and the oil is circulated by means of a suitable pump driven by the unit being oiled. Owing to the fact that the oil is forced to the bearings under a constant pressure, the oil films maintained by this pressure are capable of supporting heavier loads. Hence, smaller bearing surfaces are possible. Today, this system of lubrication is extensively used for steam turbine service, where high speeds, heavy loads and the necessity for using an extremely high grade of lubricating oil, demand the most perfect lubricating system attainable, if the unit is to be kept running day after day without hot bearings, emulsions, or other breakdowns in the oiling apparatus.

The oil which flows to the bearings, over crosshead and other wearing surfaces, is drained directly to a sump or reservoir usually in the base of the machine. From here it is pumped to the distribution system again. It can be appreciated that the sump should be of sufficient capacity to allow the returned oil to cool and precipitate any water and foreign matter which it may have collected. For this reason the pump suction should never be taken too near the bottom of the sump and it should always be sufficiently above any pos-



In the idlers of Brownhoist conveyors, as in nearly every other type of industrial machinery, Timken Tapered Roller Bearings are saving power and money



BROWNHOIST
MATERIAL HANDLING EQUIPMENT

and

TIMKEN
Tapered
ROLLER BEARINGS

Brownhoist Material Handling Equipment has been known for its perfection of design and quality for more than forty years. It is natural that the Brown Hoisting Machinery Company should maintain its policy of building only the best, by adopting Timken Tapered Roller Bearings as standard equipment in its belt conveyors. Whether in belt or chain conveyors, Timken Bearings assure

—maximum conservation of power by reducing friction to a minimum

—economy in lubrication by the ample dust-proof space allowed for grease

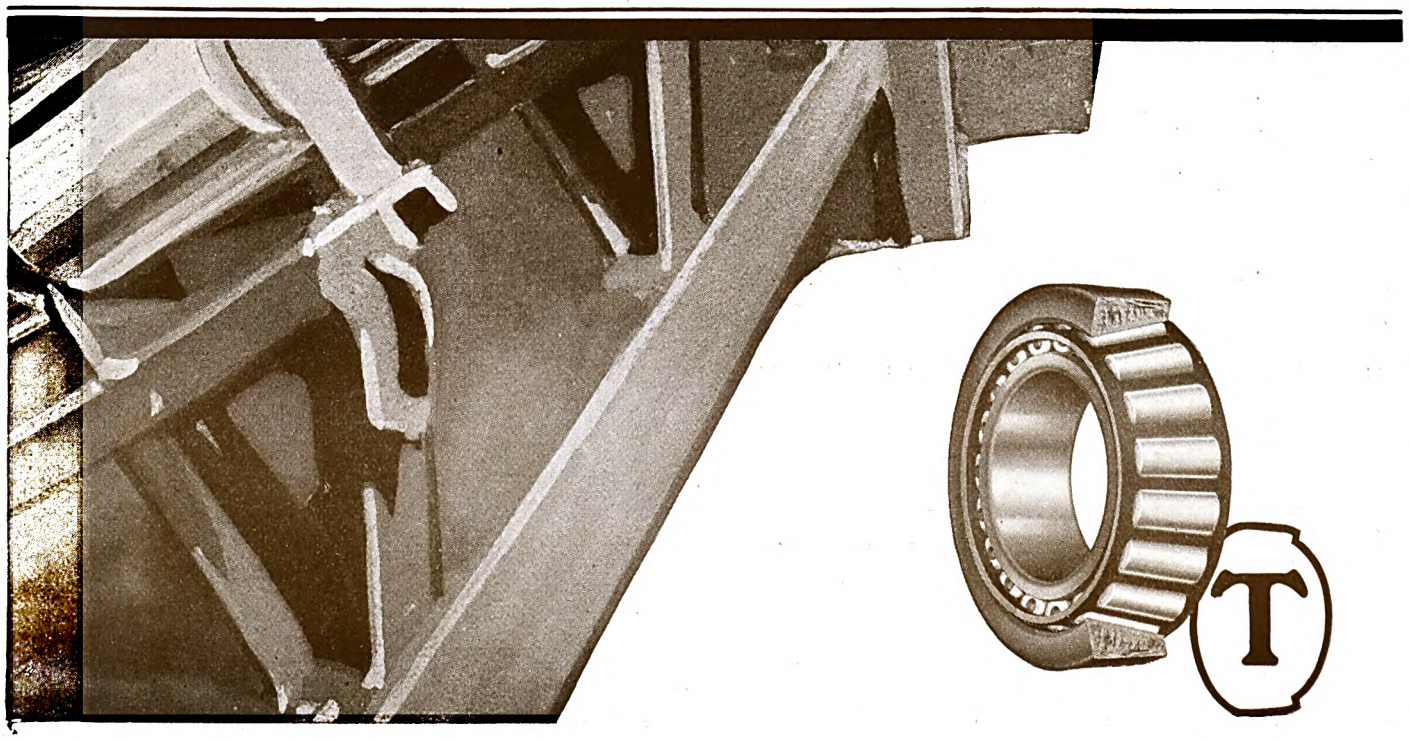
—smoother, quieter, vibrationless operation, through their ability to carry radial loads and thrust loads and resultant loads

—a longer period of attentionless, dependable service, because of the tapered principle upon which Timken Roller Bearings are built.

The heavy loads of sand, gravel, coal, or ore, and like materials, which conveyors must carry, require a bearing of the greatest stamina. That Timken Tapered Roller Bearings have that stamina is well proved by the 76,000,000 Timkens in service in all types of machinery.

The Timken Roller Bearing Co
CANTON, OHIO

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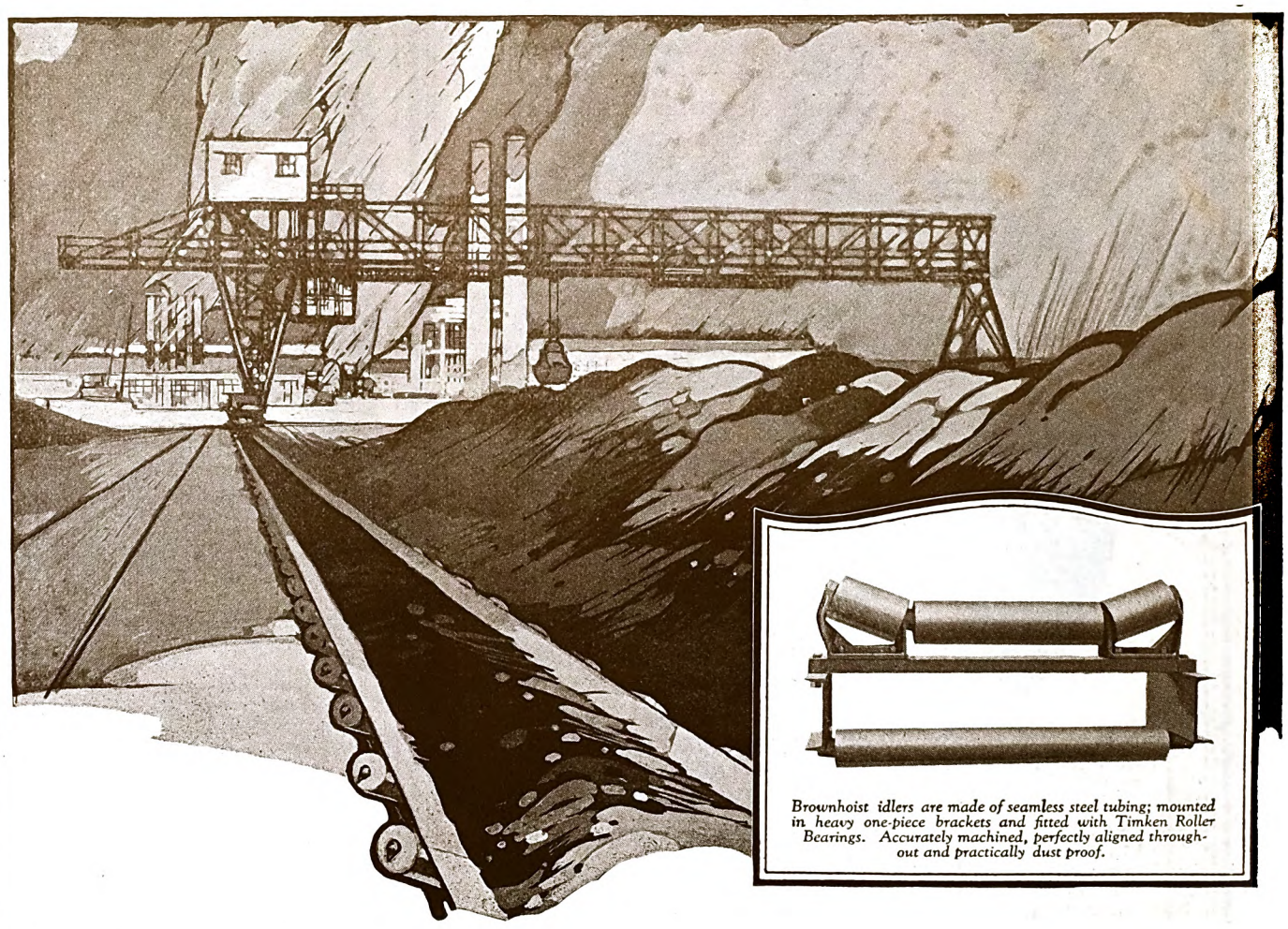
sible water level. Were water to be drawn into the lubricating system with the oil, it would often cause emulsions to form which would most certainly result in poor lubrication.

Forced feed lubricating pumps may be either installed geared to the main shaft and located in the base of the engine above the oil level in the sump, chain driven, or in the form of a rotary pump which is entirely submerged in the oil and driven from the main shaft by chain and sprocket or some other means of power transmission. It has been stated that mechanical force feed lubrication is more positive in action, but this is naturally limited to the operation of the pump and the capacity of the gravity tank. In other words, should the pump break down the supply of oil will soon cease unless the tank has sufficient capacity to carry on lubrication to serve the machine for the length of time necessary to make repairs, unless the pumps are installed in duplicate.

Splash lubrication is a popular type of installation on both horizontal and vertical types of engines where the crank case is entirely enclosed and all joints are oil-tight. It has three marked advantages, *i. e.*, simplicity, cheapness and few parts. But there is also a disadvantage pertaining that should never be overlooked, *i. e.* The oil in the crank case will be subject to fairly rapid deterioration due to the churning it receives, oxidation, lack of radiation of the heat accumulated from the bearings, emulsion with water that may leak into the system and accumulation of foreign matter such as metallic particles, dust, dirt or sludge. In operation, the crankshaft as it revolves, dips into the oil in the bottom of the crank case. By means of an attached disc, or tube device, a certain amount of oil is thus carried or thrown to the top of the crank case. Here it is trapped by grooves or pipes, or scraped off into ducts which lead it to the crosshead pin, guides, and governor mechanism, etc. The crankpin bearing generally receives its lubrication by an independent pipe through which the oil is forced during revolution. Any excess oil returns by gravity to the crank case for further usage. There should always be installed a suitable means for draining the water from the bottom of the crank case, with a gage glass attachment indicating the height of water and oil. Frequent observation is strongly recommended since, were water ever splashed up instead of oil, it would mean a set of bad bearings in a very short time. Water is the detrimental feature in both the splash and force feed systems, and due precautions should always be taken for its removal. Especially in vertical steam engines, the possibility of condensed steam draining into the crank case via faulty stuffing boxes is very prevalent. Baffle plates or secondary stuffing boxes will prevent this to a great extent, and as well, they will prevent oil from being carried into the cylinder, and will keep the crosshead free from excessive heat radiated from the cylinder.

But not only is it necessary to lubricate bearings and the other various working mechanisms of the power plant en-

(*Continued on page 41*)



Brownhoist idlers are made of seamless steel tubing; mounted in heavy one-piece brackets and fitted with Timken Roller Bearings. Accurately machined, perfectly aligned throughout and practically dust proof.

Built To Reduce Conveying Costs

Brownhoist Products

Heavy Dock Machinery
Locomotive Cranes
Monorail Trolleys
Concrete Bunkers
Chain Conveyors
Belt Conveyors
Coal Crushers
Bridge Cranes
Buckets

Literature on request

The first cost is of course important in choosing belt conveyor equipment. But, because that cost is spread over a long period of service, up-keep is a more important factor.

Realizing this, Brownhoist Belt Conveyors have been designed to reduce up-keep cost to a minimum.

Up-keep in belt conveyors is measured by wear on the belt and on the idlers and by power requirements. Brownhoist idlers are designed to give perfect alignment and a minimum of frictional resistance. Timken Roller Bearings are standard in all Brownhoist idlers and each bearing is greased by means of a high pressure lubrication system.

These features undoubtedly make the Brownhoist idlers last longer and assure longer life for the conveyor belt.

The Brown Hoisting Machinery Co., *Cleveland, Ohio*
Branch Offices: New York, Chicago, Pittsburgh, San Francisco, New Orleans

BROWNHOIST

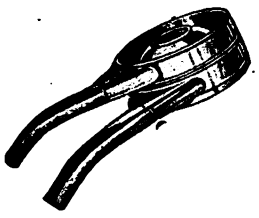
MATERIAL HANDLING EQUIPMENT

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G.P.&F. Service
SHOWING HOW SINCE 81

STAMPINGS and SHEET METAL PARTS

Made to your order and Design







IF you are now using pressed metal, let us show you the benefit of having them made in our plant. If you are using castings, forgings or wooden parts in large numbers, our engineers can design pressed steel parts to take their place.

The component parts of hundreds of mechanical products are now being made from pressed metal parts and stampings.

These offer the best solution to lower manufacturing costs and more uniformity of products.

This fifteen acre plant equipped with the most modern machinery offers ample facilities to handle the most difficult jobs without waste of time or material.

A Hundred Thousand parts of every description are turned out daily.

Over 41½ years Experience has built up a reputation as specialists in this work.

It will pay you to avail yourself of G. P. & F. Service. Send us your samples or blue prints for estimates.

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PUNCHING,
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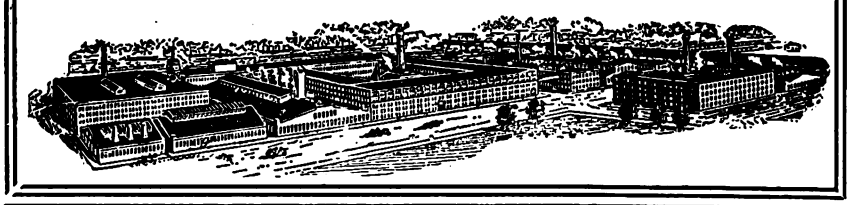
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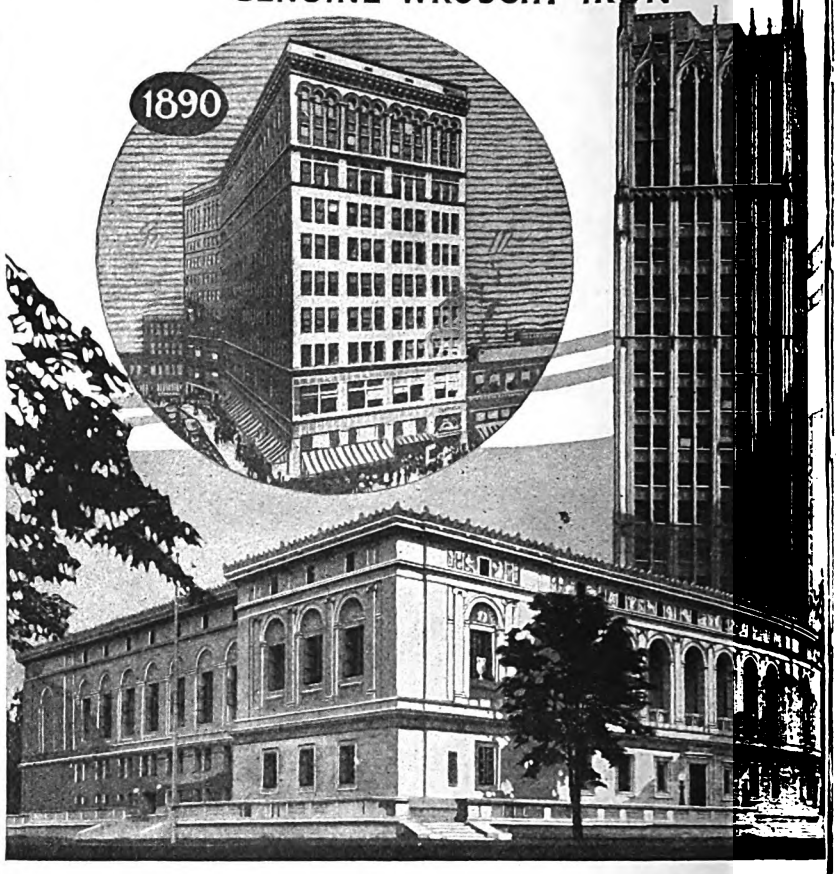
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Over 15 Acres of Floor Space



BYERS PIPE

GENUINE WROUGHT IRON



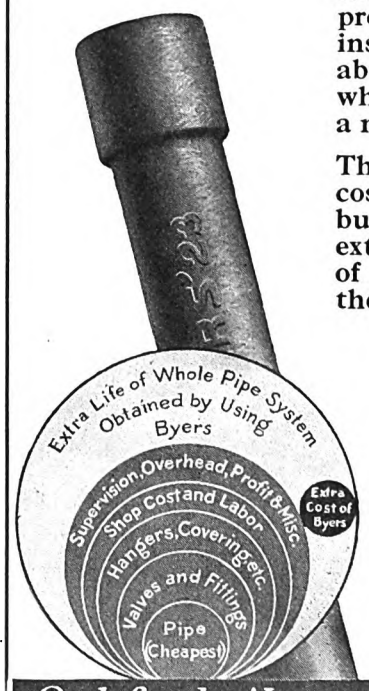
1. *Old Garfield Bldg., Cleveland, Ohio. Erected 1890. Byers pipe in heating system.*
2. *New Public Library, Detroit, Mich. Architect: Charles Gilbert, New York City. Byers pipe installed for plumbing and heating.*
3. *New Real Estate Bldg., Detroit, Mich. Architect: Louis Kamper, Detroit. Byers pipe installed throughout.*

Father Time Passes Judgment

THE rust-resistance of a metal cannot be pre-determined by laboratory tests. Only the test of time and service is decisive. So the metallurgist stands aside, waiting for the verdict of Father Time.

The Garfield Building, Cleveland, erected 1890, shown in circle above, furnishes an example of the long life of Byers pipe which is duplicated wherever Byers was installed years ago. The builders of today, profiting by this knowledge, specify and insist on the installation of Byers pipe above or underground, indoors or out, where the greatest durability is desired at a moderate cost.

The diagram shows the average items of cost in a pipe system. The pipe itself is but a small part of the total cost, and the extra cost of Byers pipe is but 5 or 10% of the total cost of the pipe system. Yet the life of the system depends almost entirely on the rust-resistance of the pipe. For when the pipe fails, the entire investment is lost, and more.



Send for Byers Bulletin No. 38 "The Installation Cost of Pipe," containing cost analyses of a variety of plumbing, heating, and power piping systems.

A. M. BYERS COMPANY
Pittsburgh, Pa. Established 1864
New York Philadelphia Boston Cleveland
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Distributors in all jobbing centers

Look for the Name and Year rolled in every length

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(*Continued from page 39*)

gine, pump or compressor. To keep the steam cylinders and valves in proper condition it is essential that the steam be impregnated with a certain amount of lubricant, prior to its delivery to each unit. Thereby a suitable film of oil will be applied to the valves, piston and rings, valve seat and cylinder wall, to prevent undue wear of these latter as the valve and piston work back and forth against them. Essentially the steam serves as a vehicle to carry and distribute the oil to every part of the mechanism it comes in contact with. To complete the process, however, the lubricant must be applied to the steam by a suitable type of positive action lubricator capable of furnishing the oil drop by drop at any desired frequency. To attain the best results the inlet connection from the lubricator to the steam pipe should be located about two feet above the throttle valve. Thus there is afforded a sufficient length of time for the steam to thoroughly atomize the oil and insure complete mixture of both. In addition, such a connection enables the throttle valve to be properly lubricated, and renders it capable of accurate adjustment to attain any desired engine speed.

In modern practice steam cylinder oils are applied either by a hydrostatic lubricator or some form of mechanical force feed device. In the hydrostatic lubricator operation is attained by the weight of a volume of water, contained either in the condenser bulb or pipe, which forces the oil from the lubricator reservoir into the steam pipe. This body of water is accumulated either by connecting the condenser to the steam pipe about two feet above the oil connection as the case with a single feed device, or extending a pipe from the main steam header down to the lubricator tank as in the multiple feed lubricating system. The principle of operation in each case is the same, however, involving merely a suitable pressure difference attained by the gravitational weight of the water sufficient to force the oil into the steam via the atomizer.

The multiple feed system is by far the more automatic of the two, and requires filling with oil but once every several days, while the single feed lubricator, in general, has but small capacity, *i. e.* One quart maximum. Naturally, therefore, frequent re-filling is necessary and its positiveness of action depends largely upon the vigilance of the engineer. The multiple feed system of hydrostatic lubrication is admirable when several steam operated, reciprocating units are included in the power plant. In such cases an oil reservoir of from five to fifteen gallons capacity can be installed, with a single condenser pipe leading to the steam header. Oil distribution to the lubricators on the various pumps and engines, etc., is carried out via a main oil header connected to the reservoir, with leads dropping therefrom to each unit as desired. This system is, however, usually not preferred on a single unit only, owing to the increased expense of erection. In such cases the mechanical forced feed lubricator is generally installed, or a single feed hydrostatic appliance.

Frequently it may be desirable to equip the steam engines and other units of the entire plant with mechanical force feed cylinder lubricators operated from the reciprocating mechanisms. In fact, many engine and compressor builders are standardizing on such equipment today. Some of these devices, however, possess the disadvantage of relatively low capacity, though on the whole, the mechanical force feed lubricator is a far more valuable equipment from the viewpoint of proper oil supply and economy. It stands to reason that an engine will not require the same amount of steam cylinder oil at low speeds as at higher rates of operation. With a hydrostatic installation the rate of oil feed is absolutely dependent upon the operator, and his judgment of the number of drops that should be fed per minute. The mechanical lubricator, however, varies the rate of oil feed automatically with the R. P. M. of the unit. Thus, after the apparatus has been set for what is technically considered a correct oil flow at normal operating speed, it requires no further attention in this regard. Such a device is

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A pulley that has cut power costs in thousands of industrial plants

Loose belts reduce friction in bearings and prolongs belt life. The oval crown of the Oneida pulley insures the greatest possible belt grip or adhesion—this permits operation under low belt tension and insures maximum transmission of power with minimum expense of belt pull or tension.

Oneida pulleys may be run with safety at any speed at which it is practicable to operate a belt.

The arms, as well as hubs of the Oneida, are made in two pieces—interwoven into the flanges of the hub and securely riveted into place.

Double arms are provided beginning at 8-inch face in the smaller sizes, 10 and 12-inch in the medium and larger sizes.

Order Oneida pulleys from your local dealer on the immediate delivery basis.

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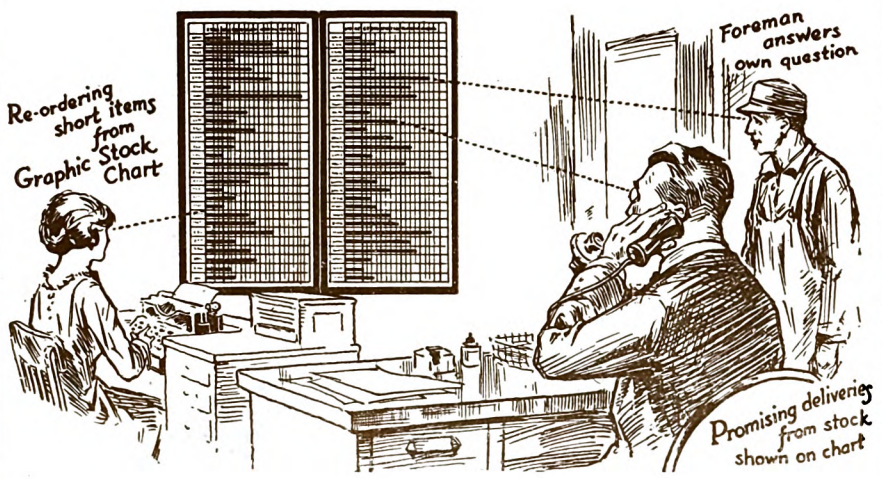
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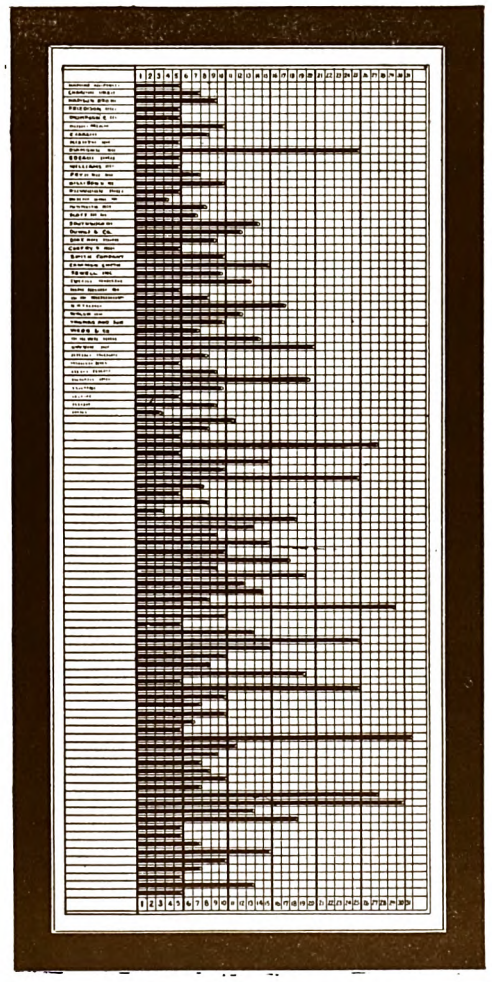
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especially adaptable to a multiple expansion steam engine, since it is generally built with two or more oil pumps whose discharge can be piped directly to each respective steam inlet.

There are a number of other steam cylinder oil lubricators in use today involving the principle of the sight feed oil cup. In general they are attached directly to the steam chest. This in itself is bad practice since any oil dropping into the chest will generally be carried in bulk to the exhaust without sufficient atomization to lubricate the wearing parts to any great extent. They are, however, automatic in operation as long as they are kept properly filled and the flow regulated.

UNIFORM provisions governing the travel of persons suffering from contagious diseases are now in force over a large part of the United States, says the U. S. Public Health Service, in a bulletin just issued. Twenty states (Alabama, Florida, Georgia, Illinois, Kansas, Kentucky, Louisiana, Maine, Maryland, Michigan, Minnesota, Mississippi, New Hampshire, North Dakota, South Carolina, Tennessee, Virginia, West Virginia, Washington, and Wisconsin) have already adopted the Standard Railway Sanitary Code approved by the conference of the State and provincial health authorities of North America and later by the U. S. Public Health Service in conference with the health officers of the United States. The essential part of the code has also been incorporated in the United States interstate quarantine regulations.

The code forbids absolutely the travel of persons ill with any of the five major quarantinable diseases: plague, cholera, yellow fever, typhus, and smallpox—the first four because they are not common, and when once started, have enormous possibilities of epidemic spread and are very disturbing to the public mind; and the fifth, smallpox, because in the present imperfect state of vaccination, the possibility of transmitting the disease from patients cannot be entirely avoided under travel conditions.

Still Best After Test of 8 Years

Invariably manufacturers wishing to prove the mechanical merit of anything resort to a rigorous test of some sort.

Abundant proof of the superiority of the Steam Trap Sarco over the costlier, more cumbersome bucket or float type of trap is furnished by two New York manufacturers who replaced float traps with Sarco Traps more than eight years ago.

For eight years the Sarco has been saving steam and money for Walter W. De Bevoise and for Henry Heide of Brooklyn—just two of the many hundreds of manufacturers who have found that the Sarco serves as a valve, a by-pass, a check valve and a steam trap all in one.

When steam is shut off at night the Sarco opens automatically and stays open until steam is turned on again. When steam comes on in the morning it forces all the air out and closes the trap, which stays shut until condensation again opens it.

You can install the Steam Trap Sarco for one-third the cost of bucket or float traps and they'll do the same work.

As evidence of Sarco dependability, we quote just a few names of prominent Sarco users:

New York Central Railroad, Pennsylvania Railroad, Erie Railroad, D. L. & W. Railroad, Consolidated Gas Company, Standard Oil Company, Atlas Powder Company, William Cramp & Sons Shipyards, and many, many others.

Let us send you a Sarco on 30 days' trial. If you are willing to part with it at the end of this period, send it back and it will cost you nothing. Write for Booklet R-20.

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What the Freight Engine is to the Railroad—
What the Tugboat is to Navigation—

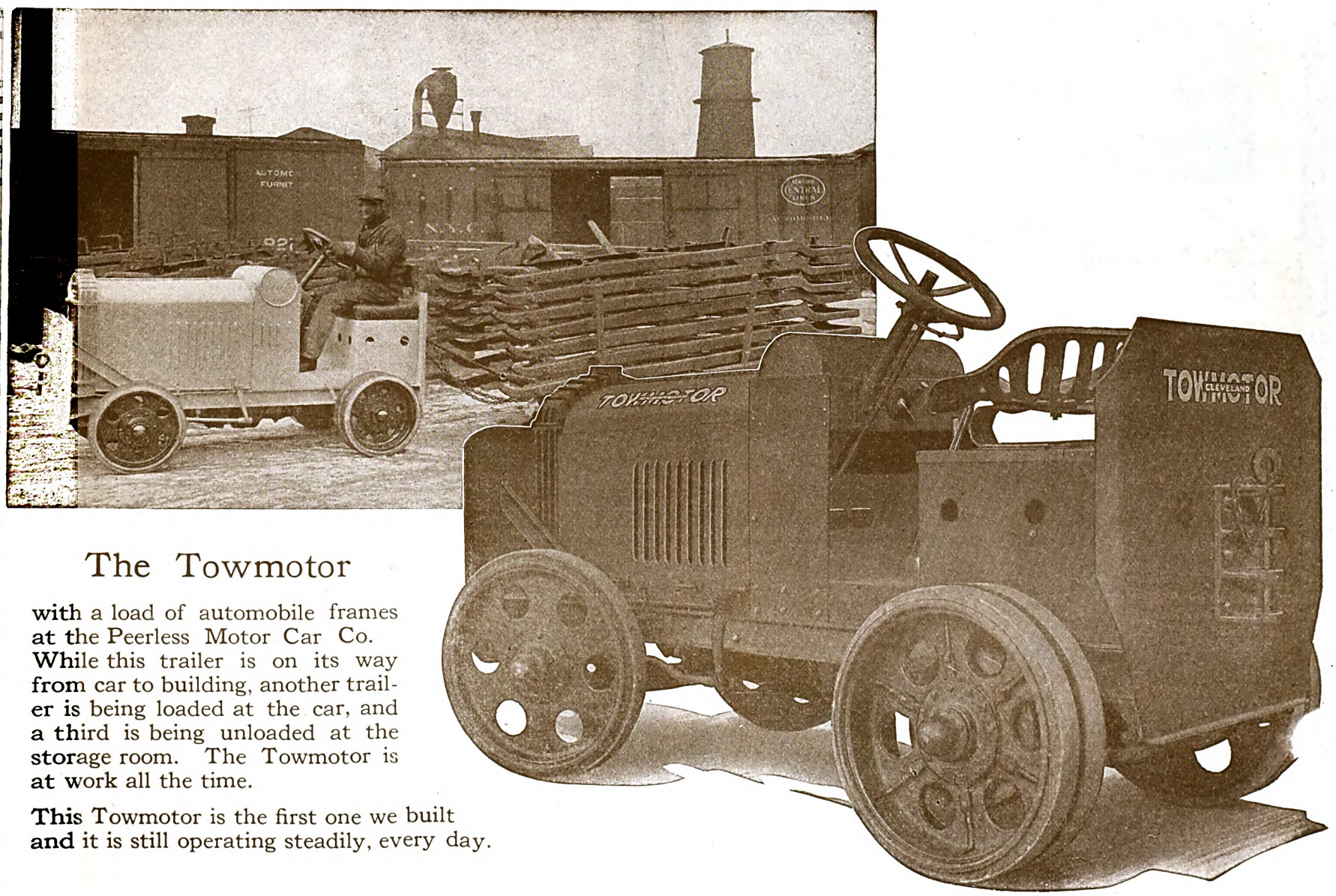
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is to Industrial Transportation.

Whether your work is inside your building or outside—Whether you want a tractor one hour a day or twenty four, The Towmotor is always on the job, always ready to go.

The Towmotor is built in the sturdiest, most substantial way we could devise, so it would stand up under the strenuous demands made upon a tractor in industrial use.

Its units are standard, which makes it easy to repair in case of accident.



The Towmotor with a load of automobile frames at the Peerless Motor Car Co. While this trailer is on its way from car to building, another trailer is being loaded at the car, and a third is being unloaded at the storage room. The Towmotor is at work all the time.

This Towmotor is the first one we built and it is still operating steadily, every day.

THE TOWMOTOR COMPANY
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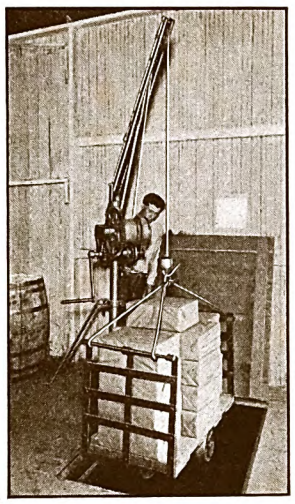
THE TOWMOTOR

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to handle loads such as the following with a G & G Hoist. Check the kind of load handling you are interested in, send this ad to us, and we will show you why it is profitable to use G & G equipment.

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- ☐ Drums
- ☐ Floor Trucks
- ☐ Rubbish
- ☐ Sacks

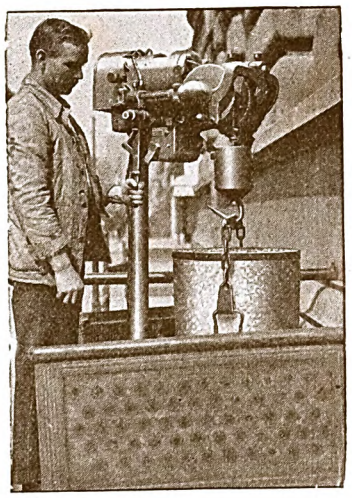


The Great Western Paper Box Co., St. Louis, Mo.
(above) uses a G & G Model B Non-Telescopic manually operated Hoist to raise and lower loaded floor trucks between floors.

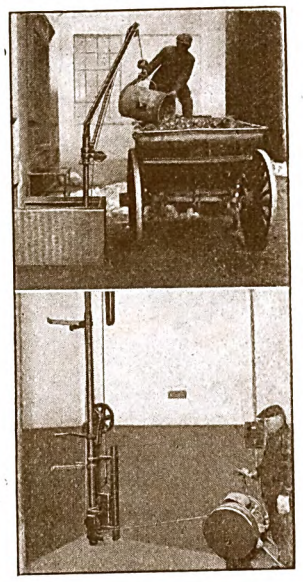
The Packard Motor Car Factory, Detroit, Mich.
(below) uses a G & G Model A Non-Telescopic manually operated Hoist to raise core sand. 3 other G & G Hoists are in this plant.



The Mergenthaler Linotype Co., Brooklyn, N. Y.
(below) uses a G & G Model D Telescopic electrically operated Hoist for ash removal. Test shows this Hoist raises and lowers 26 cans for 1c current consumption.



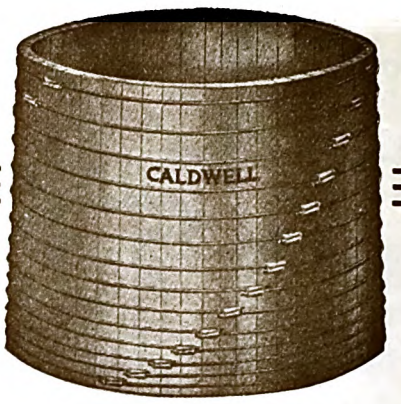
The New York Telephone Co. (main bldg.) Brooklyn N. Y.
(above) uses a G & G Model E Telescopic electrically operated Hoist for ash removal. The Bell system has 86 G & G Hoists in its various buildings.



Write for booklet— "Industrial Plants Need This Hoist."

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The G&G
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Telescopic Hoist
with Automatic Gear Shifting Brake Device and Silencer



Records Speak Volumes

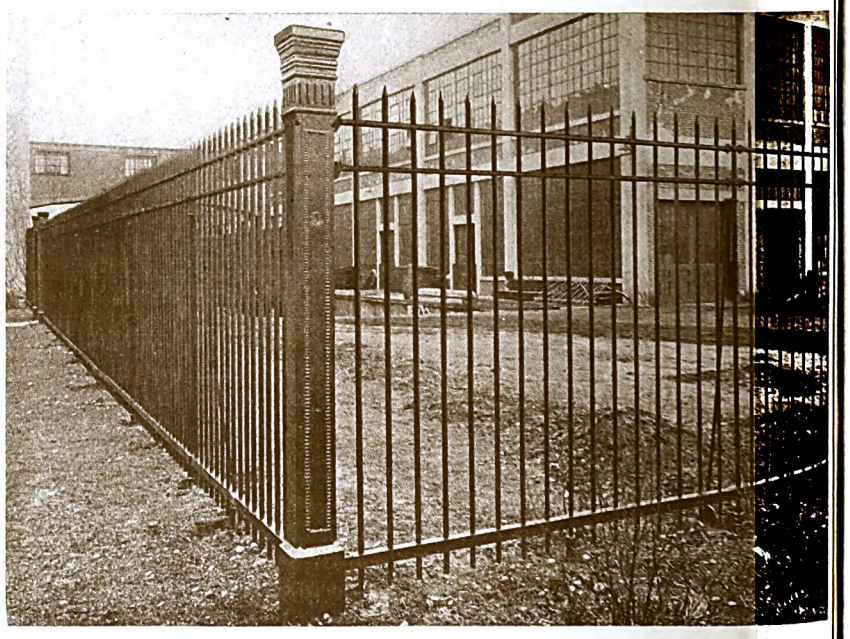
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All-Iron **FENCING** *Chain-link*

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Managing the Move

(*Continued from page 26*)

were taken separately for every type of office furniture in common use. Each element was planned and defined in advance and symbolized mnemonically, to facilitate rapid and accurate study. Then the studies were compiled and the elements figured. The results were a series of elemental times from which we could determine exactly the length of time and the number of men required to move each type of office furniture.

In managing the move of a large commercial educational organization in New York recently we had an opportunity to use and test these standards. The lowest bid received from a moving company here was $1,400. We advised that instead of letting the contract on a lump-sum basis, the job be handled on an hourly basis. This was done. The work was carefully laid out according to our standards, and as a result the cost was only $600—a saving of 57 per cent of the original bid of this same moving company.

The money paid to movers represents, however, only a small proportion of the cost of moving. Any saving here is spectacular because it shows up instantly in the expense account. But even greater than the cost of transportation is the loss caused by the interruption of business, the deflection of office workers from their regular duties to the tasks of rearranging furniture and getting settled in the new quarters. The great contribution of scientific management here is not in reducing the fee of the moving company—though that saving may be substantial—but in reducing the period of interruption to the lowest attainable minimum.

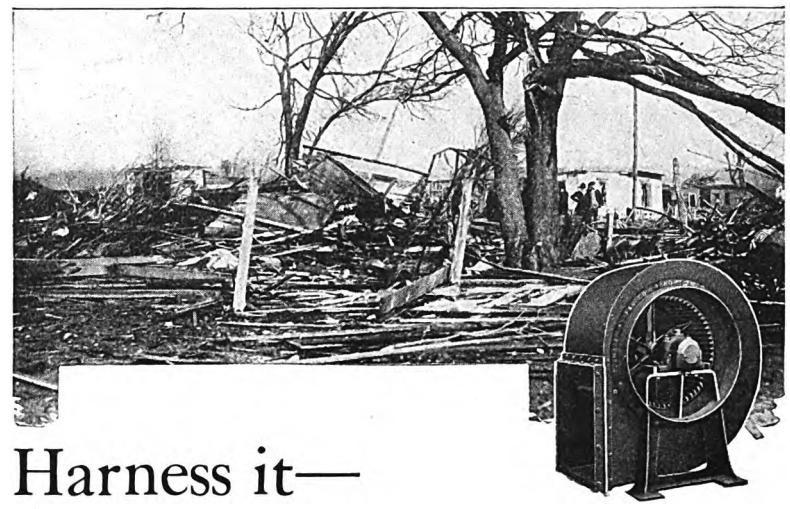
An Eastern life insurance company transferred to new offices recently. The move occupied six days, a full week. In striking contrast is the educational organization mentioned above; with scientific management it was moved in 12 hours. The movers began promptly at the stroke of 12 noon Saturday and by midnight everything was in place in the new offices—desks, files, equipment of every kind, all ready for the opening of business Monday.

The same principles of management were applied to the moving of the bank. Here the schedule called for beginning the move promptly at 1 o'clock Saturday, when the employes finished their work, the move to be completed at 11 p. m. the same day. The safe movers, a separate organization, were delayed in some way, which kept the elevators in their service until 3 o'clock. The move was therefore two hours late in starting but in spite of this handicap it was completed by 11:30, only half an hour behind schedule. Originally we planned to place the furniture in permanent position as fast as it arrived in the new quarters. But painters, plumbers, electricians, and laborers were still at work putting on the finishing touches Saturday night, so the placing had to be postponed until next day. With a few hours of Sunday work the job was completed, and the bank opened Monday, with everything in order and all the clerks at their desks, at the usual opening hour, 9 o'clock. Not an hour of working time was lost. The management of the bank showed its confidence in the move schedule by inviting its patrons to a reception Monday morning, and the customers who had transacted business at the old bank Saturday morning were astonished to find it installed in full working order in its new quarters at the opening hour Monday.

The secret of this saving of time and energy lies in the use of the twin principles of management—analysis and planning. By analyzing every factor involved in the move, every factor in the old quarters as well as in the new, and organizing a plan for handling these economically, the move goes forward as so much teamwork. The trouble with most moves is that the concerns look upon them as emergencies to be cared for by the moving company; and the moving company looks upon the job as simply one of getting so many truck loads of furniture from one place to another. But the problem of transportation is really

(*Continued on page 47*)

Moving air did this—



Harness it—
for profit in your plant

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This power seized, boxed, delivered and made to work for your profit will mean the elimination of extra and unnecessary operations and a material reduction in operating costs.

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Clarage-Kalamazoo Fans are improving air conditions, collecting dust and dirt and reducing the fire hazard. They are stopping condensation. They are increasing gas production. They are drawing off waste heat from various kinds of ovens and kilns, turning it to heating and drying purposes—and they are boosting the capacity and efficiency of boilers in every section of the country.

Clarage-Kalamazoo Fans can turn the vast powers of moving air to your profit in a hundred ways.

You have a problem similar to those above. Let our engineers know what it is. They will solve it with the right fan for the purpose.

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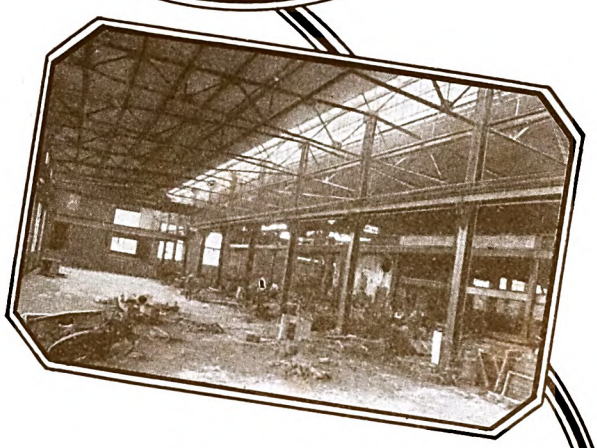


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Save Time and Money through the Beling-Bush System of Standardized Building.

YOU owe it to yourself and your company to investigate the Beling-Bush Method of Standardized Factory Construction. We can build your new plant or that addition in 30, 60 or 90 days. You'll find our work so high-class and thorough that you too will go out of your way to recommend us to your friends when they want to build. With us you save because of centralized responsibility on plans and construction and in the elimination of a vast amount of time and effort.

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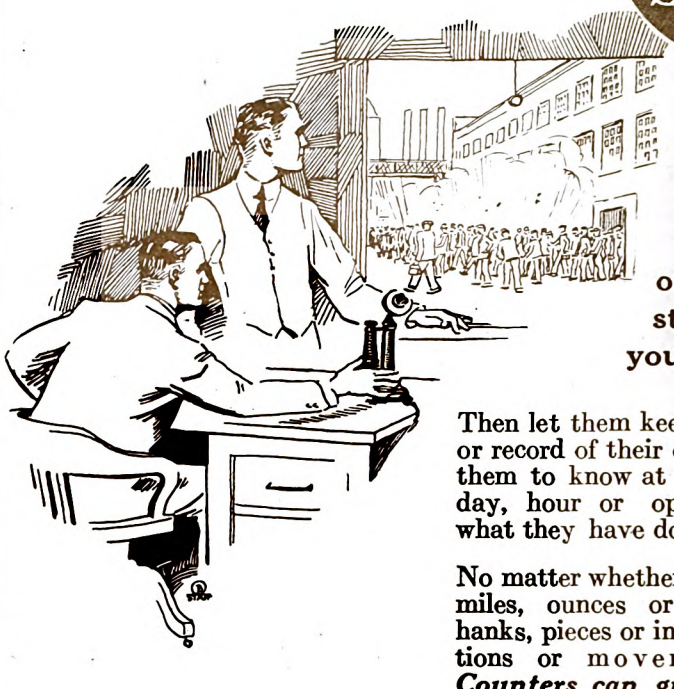
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Then let them keep accurate count or record of their own work—allow them to know at the end of each day, hour or operation—exactly what they have done.

No matter whether this is inches or miles, ounces or tons, picks or hanks, pieces or individuals, operations or movements—***Root Counters can give an accurate and verified record of it.***

Why not allow our Engineers to come to your plant, at no cost to you and see what they can save by suggestions.

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Uses 25% less ice

Prepare your plant now for summer weather

THIRST is the enemy of energy. Thus proper drinking water facilities are a most important consideration in planning your summer production.

Jewett *Square* Water Coolers--installed in connection with the regular water system, provide an ample supply of refreshing, cooled drinking water that counteracts the energy-sapping effect of hot weather, and vitalizes and invigorates your workers.

Even though your plant is equipped with coolers, you may be interested in the numerous advantages of the Jewett: its convenient, sanitary angle-flow bubbler—and the decided saving in labor and ice from its square design and thick, insulated walls.

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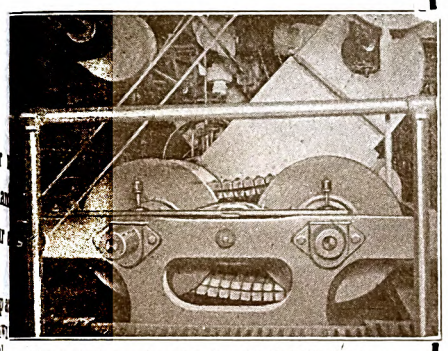
The Jewett Refrigerator Co.,
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"The Reeves"

VARIABLE SPEED TRANSMISSION



Installation of a No. 6½-E REEVES Transmission operating stoker shaft at New York Edison Co.

Variation of speeds easily and quickly obtained

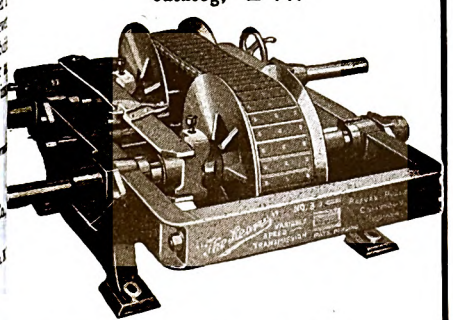
Application to stokers in lighting and power stations makes it possible to anticipate heavy loads and to take care of sudden "peaks."

By regulating the speed of stokers through "The Reeves" Variable Speed Transmission, precisely the right amount of coal is fed into the furnace at all times, assuring perfect combustion and securing the greatest amount of heat units per ton of coal.

A slow or normal fire can be maintained until there is a call for more power, or when a dark storm is approaching, then the speed of the stoker is increased by means of "The Reeves" Transmission, until the proper amount of coal is being stoked to produce the necessary power.

The original installation of "The Reeves" Transmission made with the New York Edison Company was in 1912. This machine was subjected to a rigid experimental test, which proved that it effected such great saving in coal that it paid for itself in an incredibly short time. The performance of this machine has resulted in the installation of a great number of REEVES Transmissions with this company.

Write for our new 52-page catalog, L-44.



REEVES PULLEY CO.

Columbus, Indiana

(*Continued from page 45*)

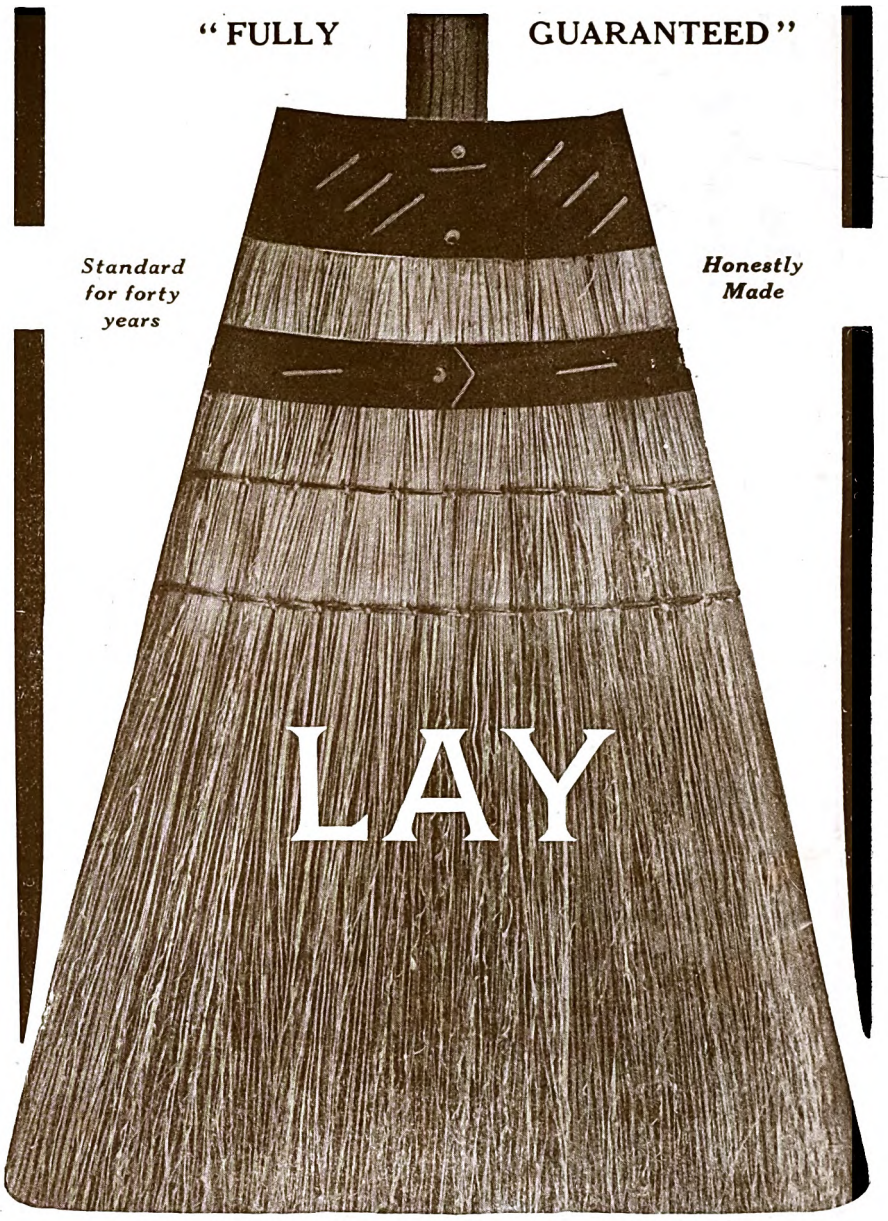
only a part of the whole problem, which includes the arrangement of the new quarters, the placing of the furniture according to this arrangement, and all the incidental details of providing means for quickly identifying equipment and assigned spaces, and facilitating the handling and prompt placing of what is moved.

The definite layout of the arrangement of furniture in the new offices is a necessary preliminary to management of the move. The procedure here is as follows: First make a floor plan of the old office, of conditions as they now are. The whole should be carefully drawn to scale, every piece of equipment indicated. It may be that in this survey of present conditions certain pieces of furniture can be marked for the second-hand shop. This is one of the blessings of a move, the opportunity it gives to get rid of old equipment which has outlived its usefulness and to purchase new standardized equipment. Where such pieces of furniture are marked for discard, the problem of moving is simplified to that extent; for the old furniture may be left behind for the second-hand buyer, and the new furniture will of course be delivered in place at the new quarters by the seller.

After the floor plan of the present office has been made, draw a plan of the new office space. It will be bare, of course; just a plan of the empty room or rooms to which removal is to be made. The next step is to cut up the floor-plan of the present office into pieces representing the furniture to be moved. This will give a series of templates, which may be moved around on the floor plan of the new office, tried in various positions until the right arrangement is decided on. In planning the new arrangement there is a glorious opportunity to iron out all the defects of the old arrangement—place desks and departments so as to facilitate the routing of work, with proper care also for such items as lighting, ventilation, traffic, intercommunication, cloak rooms, drinking water, and the like. But that is another story.

(Obviously the furniture to be left behind does not figure in this planning, but the new

(*Continued on page 49*)



DURABILITY

THIS vital quality in the Lay Metal Case Broom has enabled thousands of manufacturers to cut their sweeping expenses in half. The long life of our products in the hardest, roughest kind of service means smaller sweeping bills and infrequent re-orders.

Just see the lasting construction and the durability of the materials in these metal case brooms. Every one of them is made from selected stocks of broom-corn, rattan, hickory or bamboo—constant inspection during manufacture insures the use of only the best quality of raw materials. Every broom is constructed according to the best approved scientific engineering principles and the reason why

"They hold their shape till worn to a stub."

Every strand of fibre is held in place in the vise-like grip o staples—not nails. The staples are driven under high pressure and clinch on both sides; there isn't a chance of falling fibre from this construction.

Knock the broom against sharp corners or heavy machinery,—you can't crack or splinter the shoulders,—they're protected by the strong metal case,—doubly re-inforced.

Their sturdy construction, long life, and low cost are responsible for the specification of LAY brooms by 90% of the steel industries, 40% of the railroads and more than 4000 industrials. Every year the

STRENGTH, DURABILITY and ECONOMY

of LAY products are saving these concerns thousands of dollars in sweeping expenses.

These same qualities are built into each of our complete lines of industrial brushes. Every LAY product is backed by three generations of specialization and is unconditionally guaranteed,—you are fully protected.

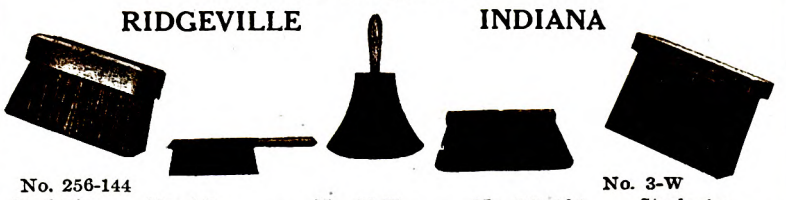
Send for our prices to place your trial order. We are responsible for your satisfaction.

Originators of the Metal Case Broom

THE JOSEPH LAY COMPANY, INC.

120 College Street

RIDGEVILLE INDIANA



No. 256-144 Steel wire Push Broom

No. 412 Bench Brush

No. 28-H Bassine Whisk

No. 253-165 Bass Push Broom

No. 3-W Steel wire Casting Brush

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THE SIXTH SENSE OF INDUSTRY

Tycos Temperature Control



The SIX SENSES
Seeing
Feeling
Hearing
Smelling
Tasting
and
Tycos Temperature Control

You Hear Famous Artists—Thanks to the "Sixth Sense"

PLACE a record on your phonograph, drop the needle into place and the glorious tones of a famed tenor fairly shake the walls, the soft melody of a woman's voice charms the twilight, or the machine re-creates the sound of violin or piano. You perceive these things by the sense of hearing, to be sure. But, behind the miracle that reproduces the sound waves lie years, of past toil and present accuracy in the perfection of every detail of the phonograph and record. Consider the record itself. It is a tough, elastic substance, composed of certain compounds that must be accurately blended. In this process, heat is employed. The control of this temperature must be exact if the finished "blank" is to prove properly susceptible to reproducing the sound waves when it is pressed by the master record. Behind the making of this master record itself—behind every step in its plating and electroplating, clear back to its production as a plaster cast of the original wax impression of the original harmony, the control of temperature—the "sixth sense" has become as much a part of the everyday industrial world as the sense of hearing itself. The records you listen to are perfect because the records of *Tycos* Instruments that controlled the temperatures employed in their physical production were perfect.

Listen, then, to the voice of American Industries—the voice that proclaims the 8,000 varieties of *Tycos* Temperature Indicating, Recording, Controlling Instruments as the standard of accuracy. Their record extends over years of usage—in conditions that parallel your industry.

MANUFACTURERS

What is your problem of applying this "sixth sense" to your plant? What do you make? Write us and literature on any instrument or type of instrument will be sent you promptly. *Tycos* experts are ready to advise on its application to your plant.



Taylor Instrument Companies

MAIN OFFICE AND FACTORY:
ROCHESTER, N. Y., U. S. A.

Canadian Plant: Tycos Building
Toronto, Canada

There's a *Tycos* or *Taylor* Temperature Instrument for every purpose.

Tycos Temperature Instruments
INDICATING · RECORDING · CONTROLLING

343



An *Osborn Survey* merely requires an invitation on your part—there is no obligation.

THE longer we build brushes (this is our 31st year) the more keenly we realize that both the manufacture and the use of brushes is a science not to be mastered by hit-or-miss, rule-of-thumb methods. That is why we have established the *Osborn Brush Survey* as the basis of the procedure in advising a customer. We can't sit at a front office desk and advise intelligently but we can when an Osborn man has made a first hand inspection of your brush uses.

Brush Division of
THE OSBORN MANUFACTURING COMPANY
INCORPORATED
CLEVELAND
New York Chicago San Francisco Detroit

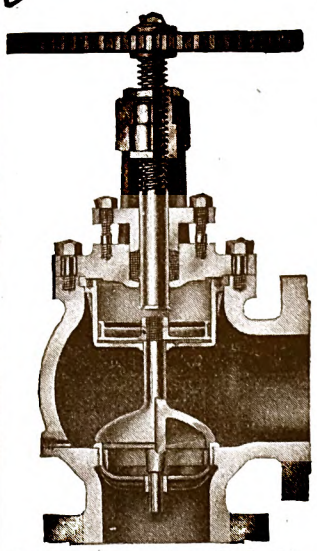
OSBORN

Made for maximum service not merely the average

TRADE JENKINS MARK

Jenkins Bros

To equalize pressures and as a safety feature



Sectional view Fig 293, Jenkins Extra Heavy Iron Body Automatic Equalizing Stop and Check Valve.

This valve automatically shuts off the flow of steam from header to boiler in case a tube should burst or other internal rupture occur, thereby suddenly reducing the pressure in that boiler.

It also equalizes pressures between different boilers in a battery, preventing one boiler form working at a lower pressure than another.

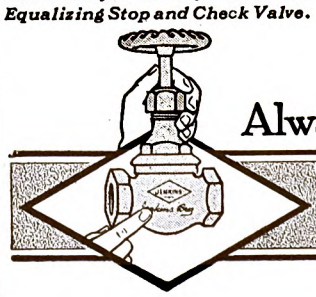
As the valve can only be opened by the pressure in the boiler to which it is attached, it is impossible to accidently turn steam into a boiler which is being cleaned.

Send for descriptive folder.

JENKINS BROS.

80 White St.....New York
524 Atlantic Ave.....Boston
133 No. Seventh St.....Philadelphia
646 Washington Blvd.....Chicago

2720-J



Always marked with the "Diamond"

Jenkins Valves

SINCE 1864

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(*Continued from page 47*)

furniture to be bought and added does. Accordingly templates of the new pieces, drawn to the same scale as the old, must be made and used in laying out the arrangement. Usually it is better, if conditions permit, to have the new furniture delivered in advance of the move.)

The arrangement planned, the next step is to plan the move and organize the means to be used. There are two important preliminaries here.

First, make a survey of the entire situation for possible checks. Consider how to get out of the old building as well as how to get into the new. In moving the educational institution, there was only one elevator. It was a rickety affair, not guaranteed to carry more than 900 lbs. In order to be on the safe side we felt it was not wise to put more than 800 lbs. on the elevator, and limited our loads to this weight. That elevator was the neck of the bottle. No matter how fast we could move elsewhere, everything was limited in its transportation by that capacity of the elevator. Should it break down during the move, everything must stop until it were fixed. Accordingly we provided for repair men to be subject to instant call. Sure enough, the elevator did break down, and we were delayed an hour. But had it not been for the preliminary survey and the consequent provision of repair men, that break down might have delayed us a whole day.

A second preliminary in planning the move is to look out for jonahs. Sometimes there is a perfectly innocent looking piece of furniture that is practically one of the fixtures. It is screwed down, connected with pipes, or complicated with electric wiring. In one case I found some bookkeeping desks wired for desk lamps. The wiring was placed in iron conduits, and the desk could not be budged until these conduits were taken down and the wires disconnected— a job of seven or eight hours for one man. In moving a bank, we had to deal with several heavyweight desks of enormous size. They would not pass through ordinary entrances. We had to build special bridges to carry them over the office partitions, and handled the removal of these safes separately as a special job in advance of the regular move.

After all the surveys have been made, the exceptions noted and cared for, the task of organizing and planning the move proper is tackled. The following outlines the order of procedure here:

1. Make complete lists of all equipment: (a) a list alphabetically by users' names, (b) a department list, and (c) a list by kinds of equipment.

2. Tag the furniture as to its disposal. Place large printed cards "DO NOT REMOVE" on the pieces to be left behind for the second-hand man. The labels on the pieces to be moved should indicate clearly for each piece its future location in the new office. In moving the bank, for example, a red tag indicated the first floor, a blue tag the second floor, a yellow tag the third floor, and a white tag the fourth floor. The number of the bay, the name of the occupant, and the number of the piece in the floor plan was marked on each tag. It took



to clean RIGHT ask JOHN BRIGHT

JOHN BRIGHT cleans mineral oil from three "Hard Ones" at the same time with International Compound No. 4B at 7c a pound

HAVE you ever tried to clean burnt-on mineral oil from steel, and buffing dirt from brass and copper in the same washing machine, at the same time? That's what I ran up against at the plant of one of the world's largest electrical corporations.

Many cleaners have been tried on this job. One tarnished the brass and copper; another would not clean the steel; another contained sediment which clogged the drains, and so on.

When I came on the job, they were using an 11 cent cleaner that contained insolubles. The steel work had to be held in the machine to get it clean. They were charging the machine with 27 pounds of this cleaner. I put in 14 pounds of INTERNATIONAL COMPOUND No. 4B at 7 cents a pound. It worked like a charm! Steel, brass and copper pieces were put through indiscriminately, and they all came out CLEAN.

INTERNATIONAL COMPOUND No. 4B saved them 2/3 their cost every time they charged the machine. Better still, it insured them consistently clean work without the objections of insolubles in their cleaner.

I'm telling you this to prove what good cleaners we make. My No. 4B suited this problem to a "T." With a line of over forty different cleaners I have one that will meet your conditions exactly. Which one will it be?

Drop me a line telling me your particular trouble. Or if you're suited, give me a chance to see if I can't save you a wad of money. If I don't satisfy you in every respect, you do not have to pay a cent for the trial lot I send you.

Why not give me a chance to back up some of my claims? Invest your two cents now!

Internationally yours
John Bright

International Products IC International Chemical Co

INTERNATIONAL CHEMICAL CO.

PHILADELPHIA ~~~~~ PENNA.

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only a glance at the tag to tell by its color which floor to carry the desk to, and reference to the markings on the tag showed the bay and the position in the bay. In addition to this careful tagging of the furniture, the bays and spaces in the new building were conspicuously marked. Large cards bearing the number of the bay were suspended from the ceiling in each bay of the four floors, thus making it easy for the movers to carry a piece of furniture directly to its position as fast as delivered.

3. Draw up a definite plan of organization, showing how every man connected with the moving is to function. In moving the bank, we organized the moving company's workers into eight gangs, as follows:

Assigned to the old building

Gang 1, clear room;

Gang 2, put furniture on elevator;

Gang 3, take furniture off elevator;

Gang 4, load furniture on van.

Assigned to the new building

Gang 5, unload furniture from van;

Gang 6, load elevator;

Gang 7, unload elevator;

Gang 8, put furniture in final position.

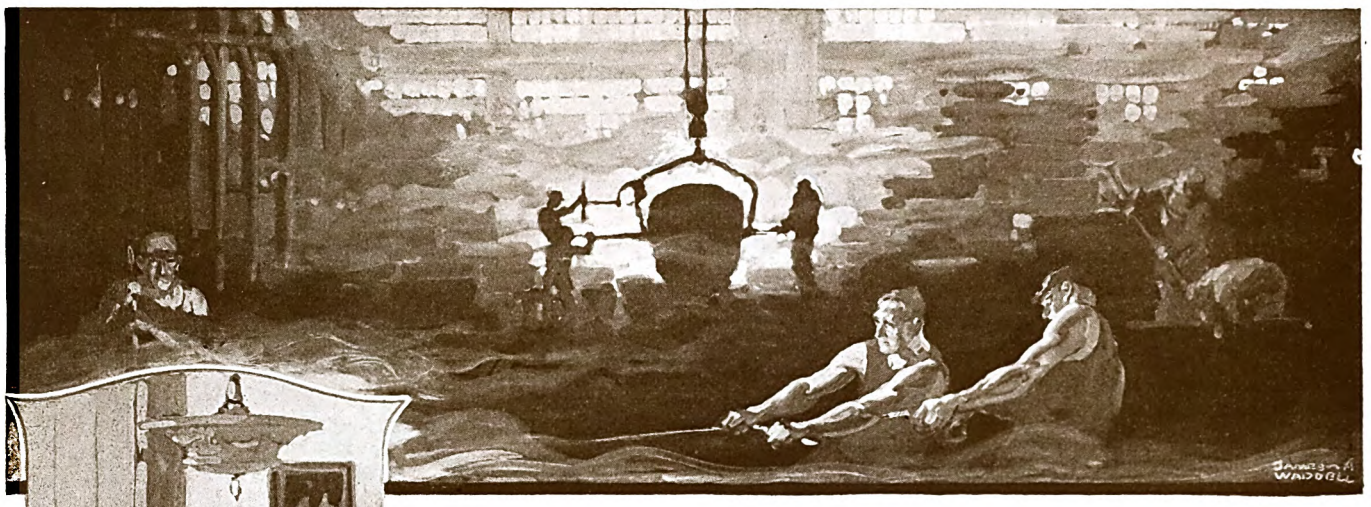
This layout of routine provided a steady flow of the furniture from position in the old building to position in the new.

4. Draw up complete instructions for superintendents, guides, and moving gangs, these varying of course with the nature of the work. In addition to instructions to those employed directly in the moving, the employes must be instructed how to put their desks and material in condition for the move.

It is my plan to have all work stop in the office one hour before the beginning of the move. This allows ample time for each man to get his papers and other desk material in order, bundle them up in wrappers provided for this purpose, tie them up securely, and label them with his name and desk number. It is very important that this be done. Papers left in desk drawers may drop out; confusion is very likely. The moving company places emphasis on not scratching furniture, but the real danger lies in losing papers. To the eye of a laborer a valuable contract does not look any different from a casual memorandum, and a few papers dropped out of a desk mean nothing to him. The only safe way is to require that everything in a desk that is to be moved first be wrapped into a bundle, properly identified with the desk; and it is naturally easiest to make each man responsible for bundling up his own material.

Not only are the instructions written, but we personally coach the section and department heads on how to answer the innumerable questions that employes will ask. We caution them against common mishaps. One of the commonest is that of bundling inkwells, bottles of ink and of paste in with papers, or shoving inkwells into desk drawers. We warn against this every time we give instructions to a group; and yet in every move there is some fellow who bundles up the ink with other desk material and spoils a lot of papers in consequence. This error, re-

(Continued on page 53)

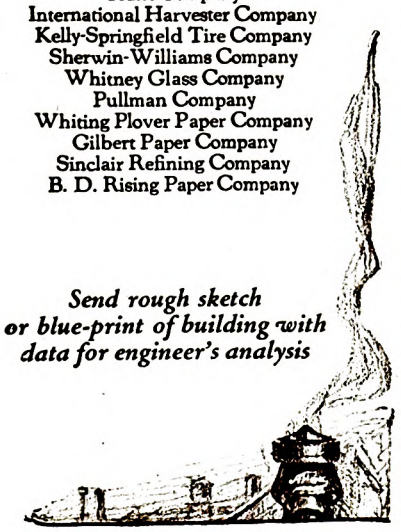




World-known leaders in every branch of manufacturing are found on the list of Arex Installations:

Carnegie Steel Company
Packard Motor Company
Bethlehem Steel Company
American Steel & Wire Company
American Car Company
Ford Motor Company
Armour and Company
Standard Textile Products Company
Studebaker Corporation
Stewart Mfg. Corporation
Semet-Solvay Company
Cadillac Motor Company
Corn Products Refining Company
Crane Company
International Harvester Company
Kelly-Springfield Tire Company
Sherwin-Williams Company
Whitney Glass Company
Pullman Company
Whiting Plover Paper Company
Gilbert Paper Company
Sinclair Refining Company
B. D. Rising Paper Company

Send rough sketch or blue-print of building with data for engineer's analysis



The Arex survey blank gives your problem the attention of specialists

INDUSTRIAL VENTILATION, unless correct, is useless. Mere installation of vents and apparatus alone is not sufficient. *Conditions* must be corrected—steam, heat, smoke, foul air or gas must be removed to make labor easier, more productive, and more profitable.

For more than fifteen years Arex engineers have been freeing industrial buildings of these profit-destroying conditions—counselling with the executives of every industry to effect savings in hundreds of branches of manufacture.

By virtue of this experience their recommendations are worthy of a confidence that busy executives appreciate, and the handy specification blank found at the lower corner of every Arex advertisement usually starts its journey at the conference table where the men congregate who are quick to realize the savings possible.

It will bring you a correct solution of *your* problem without cost or obligation. Attach a rough sketch or blue-print of the building and address Arex Company, Engineering Division, 1583 Conway Building, Chicago.

AREX COMPANY
J. C. Kernchen, Pres.
INDUSTRIAL VENTILATING ENGINEERS

Arex Ventilation Engineering Survey SPECIFICATION BLANK

We desire to receive *Gratis* an engineer's analysis of the following building: ..... *State character of work or business building is used for*

We are troubled with: Fumes ☐ Smoke ☐ Foul Air ☐ Heat ☐ Condensation ☐ Steam ☐

Dimensions of Building: Width.....Ft. Length.....Ft. Ceiling Height.....Ft.

Construction of Building: State whether Brick ☐ Concrete ☐ Frame ☐ Stucco ☐

Type of Roof: State whether Flat ☐ Slant ☐ Gable ☐ Sawtooth ☐ Monitor ☐

Pitch of Roof..... State how many..... inches to the foot.....

Location of Floor or Room to be ventilated.....

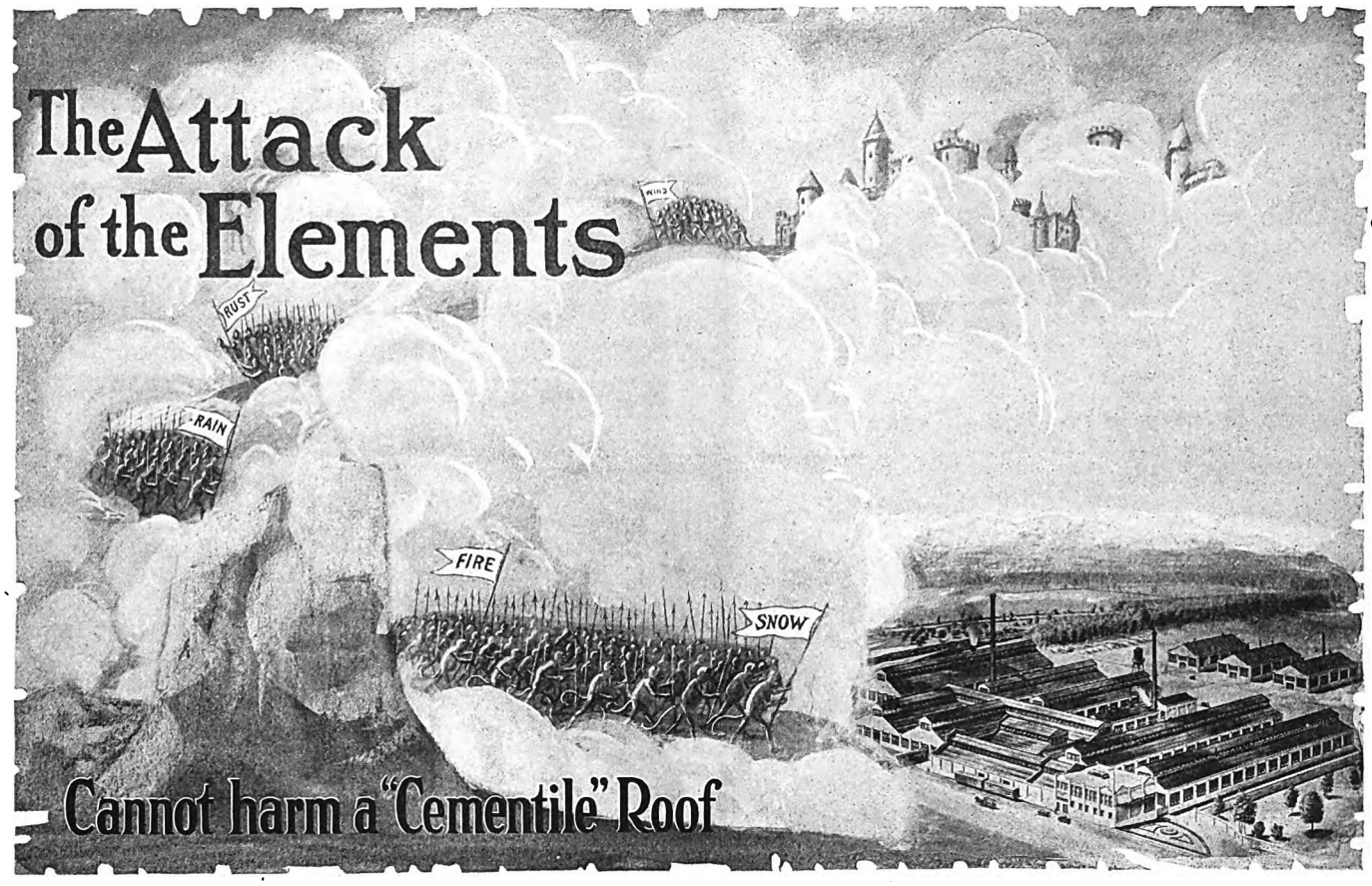
How high do adjoining Buildings extend over your Roof?.....

How many feet distant are the surrounding Buildings, or is your Building entirely unsurrounded? .....

....
Firm Name Name of Individual Title of Individual

....
Street Address City State

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Here they come. No sooner is the roof finished than the army of the elements commences its attack.

Tramp, tramp, tramp. Snow, Fire, Rain, Wind, Rust, Temperature Change march forward with eager zest. It is only a matter of time before one or all of these demons effect an entrance and the roof is doomed. Constant painting and repair will but prolong its life a limited span of years.

There is only one defence against this inevitable destruction.

BONANZA "CEMENTILE"
The Big Red Tile Roofing

Concrete is the only known material that gains strength with age. A "Cementile" Roof on your building will last as long as the building endures. "Cementile" comes in slabs 26 in. x 52 in. and is adapted to both flat and pitched roofs. It is guaranteed to withstand 200 lb. per sq. foot uniform load and is impervious to fire, rain, wind or rust.

"Cementile" should be on your next building.

Write for our new beautifully illustrated book. It will show you photographs of "Cementile" installations and give working drawings for different types of construction.

Write Today

BONANZA CEMENTILE

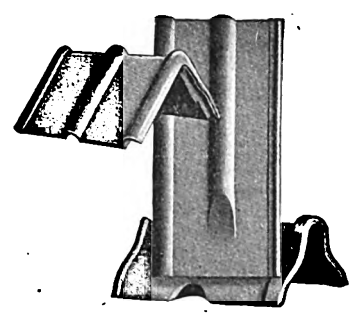
American Cement Tile Manufacturing Co.
831 Oliver Building, Pittsburgh, Pa.
PLANTS: Wampum, Pa. Lincoln, N. J. · Birmingham, Ala.
OFFICES: Pittsburgh · New York · Philadelphia · Cleveland · Birmingham

This is the first of a series of advertisements showing the destructive forces that must be avoided in building a *permanent* roof. The second will appear in an early issue.

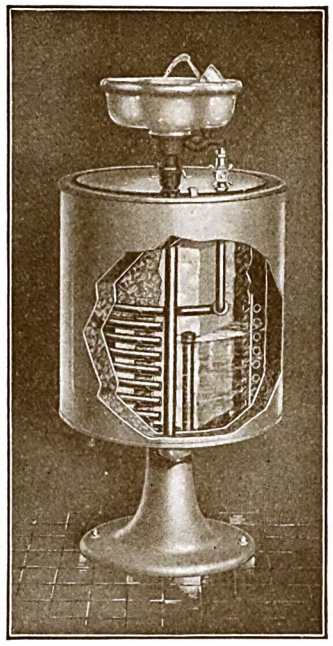
Bonanza "Cementile" is a reinforced cement tile roofing, with a pleasing outer surface, laid directly on the roof purlins. It is light, but very strong in structure, and absolutely fireproof and waterproof. Made for flat or pitched roofs, new or old.

CEMENTILE

The first cost of a Bonanza "Cementile" Roof is the last cost. We make and lay the roof, and unqualifiedly guarantee the material and labor.



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If Our Figures Don't Lie You're Losing Thousands Of Dollars

Were we to tell you that thirst-quenching is costing you between $3600.00 and $6000.00 per year for each 200 men, would you believe us?

If your men are compelled to wait, *in vain*, at a water faucet for the water to cool, will they average 3 minutes per drink?

Do they average 6 drinks per day? Is their average wage as much as 30 cents per hour?

3 minutes × 6 drinks × 30c per hour= 9c per day per man
9c × 200 men × 300 days = $5400.00 per year.

Halsey Taylor Instantaneous Cooler Fountains at frequent intervals throughout your plant cut the average time per drink to less than one minute, saving several thousand dollars annually.

Result:- Improved working conditions, healthier workmen, increased production—and thousands of dollars added to your income.

Write today for 32-page catalog and prices.

THE HALSEY W. TAYLOR CO.

No. 529 Park Ave.
Warren, Ohio

BRANCHES

NEW YORK CITY
137 East 43rd Street

CHICAGO
1702 North Talman Ave.

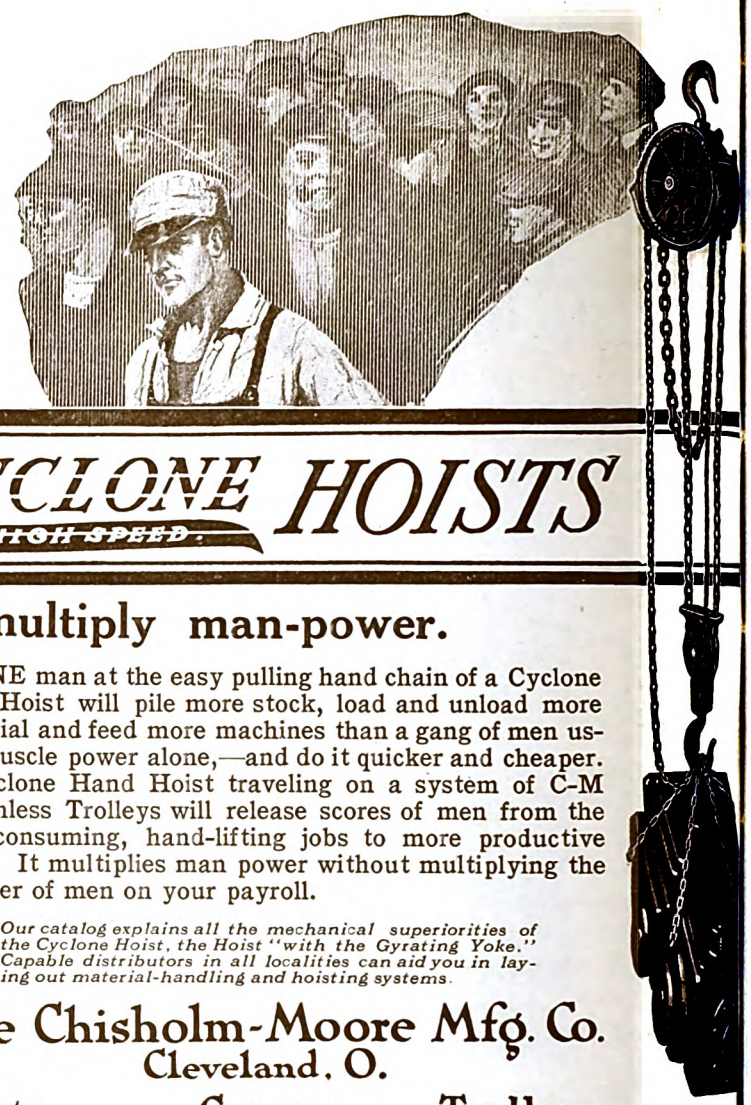
PHILADELPHIA
5224 Greene Street

KANSAS CITY
3838 Troost Ave.

BOSTON
46 Cornhill—Room 512

SAN FRANCISCO
237 Rialto Building

HALSEY TAYLOR



CYCLONE HOISTS
HIGH SPEED

—multiply man-power.

ONE man at the easy pulling hand chain of a Cyclone Hoist will pile more stock, load and unload more material and feed more machines than a gang of men using muscle power alone,—and do it quicker and cheaper. A Cyclone Hand Hoist traveling on a system of C-M Matchless Trolleys will release scores of men from the time-consuming, hand-lifting jobs to more productive labor. It multiplies man power without multiplying the number of men on your payroll.

Our catalog explains all the mechanical superiorities of the Cyclone Hoist, the Hoist "with the Gyrating Yoke." Capable distributors in all localities can aid you in laying out material-handling and hoisting systems.

The Chisholm-Moore Mfg. Co.
Cleveland, O.

Hoists Cranes Trolleys

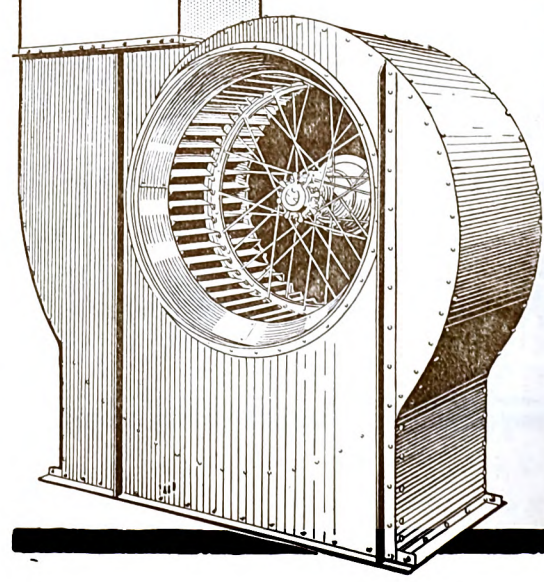
Branches: New York, Chicago, Pittsburgh

EFFICIENT VENTILATION

Can be obtained only through the use of equipment designed to meet the specific requirements for which it is intended.

Bayley PLEXIFORM FANS

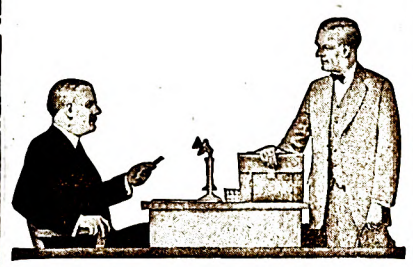
are made in a variety of capacities from 300 to 300,000 cubic feet per minute. They are designed especially with a view of handling a maximum volume of air from a minimum of space and power requirement. Their efficiency as proved by installations in thousands of the largest industrial, public, school, theatre and office buildings, makes them prime favorites with architects, engineers and owners.



Write for Catalog

BAYLEY MFG. CO.
DEPT. (P)
MILWAUKEE, WIS.

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"IT'S YOUR ORDER, Because Your Company Has a PHOTOSTAT."

"This is a job where delivery is paramount. And, in every case, I have made it a point to find out what kind of equipment the bidder had in order to make good his promise.

"Your Company has a piece of equipment on which I have learned to rely. I know what the PHOTOSTAT is and what it can do. I know you will not have to lose any time tracing. You can make PHOTOSTAT copies and get started on your shop work right away. In other words you'll be days ahead and I also know that there can't be any mistakes in PHOTOSTAT copies.

"Yes, sir, you tell your chief he can thank the PHOTOSTAT for this order. I know you'll make delivery with that machine to help you.'

PHOTOSTAT prints cost cents. Compare this with what it costs for a draftsman to make a tracing, a stenographer to copy a page, or an artist to reproduce a layout.

The experiences of many users, written in letter form, are contained in our booklet, "A Good Word for the PHOTOSTAT." Write for your copy today.

PHOTOSTAT CORPORATION

295 STATE ST., ROCHESTER, N. Y.

88 Broad St., Boston
123 W. Madison St., Chicago
209 Leader Bldg., Cleveland
7 Dey St., New York City
510 North American Bldg., Philadelphia
317 Third Ave., Pittsburgh
429 Monadnock Bldg., San Francisco
601 McLachlen Bldg., Washington

Executive Office: Providence, R. I.

PHOTOSTAT
Trade Mark

(*Continued from page 50*)

peated many times in my experience, shows how difficult it is to get ideas over to people.

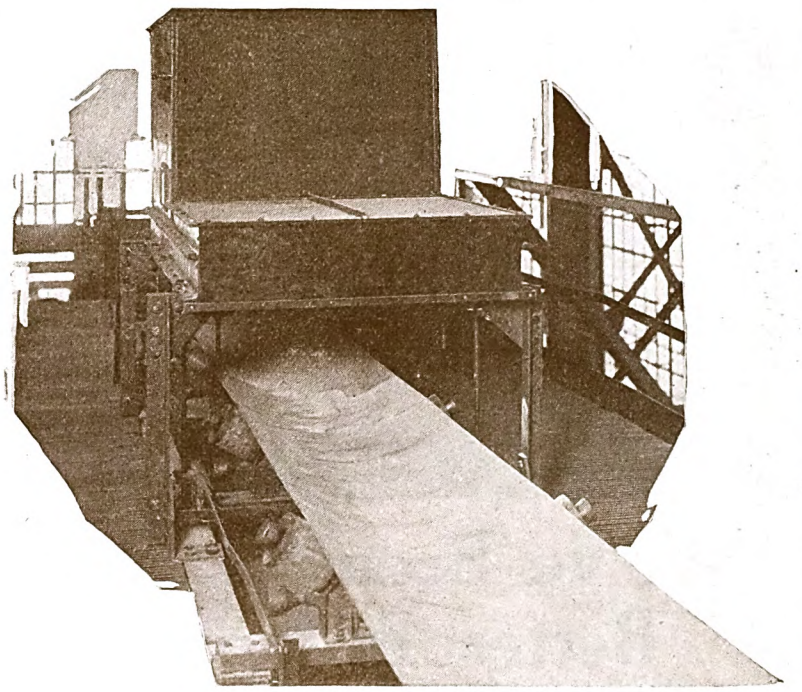
5. Handle the exceptional problems separately, usually in advance of the move. This refers to such things as extra large or extra heavy equipment, furniture that is connected with fixtures, and other exceptions—the jonahs that I mentioned earlier.

6. Schedule every step of the move. An aid to this is a large chart showing in graphic form the scheduled time for moving each department. Photostat copies of this chart may be distributed among the heads of departments and others who are to be guided by its schedules.

7. Finally, all plans and schedules having been made and all instructions given, the organization is complete, and the actual work of moving is begun. The important thing here is to follow the schedule and conform strictly to the plan throughout. Begin on schedule time and follow through the routine as laid out, for a delay or departure at one point may hold up progress all along the line. Progress involves not only getting the furniture out of the old offices expeditiously and transporting it to the new, but placing it in position in the new. The men employed as placing guides at the new building are very important in this connection. Their duty is to see that each piece of furniture is put in its final position as soon as it arrives. Each of these placing guides is in charge of a certain number of bays or a specified area of floor space in the new building, and is responsible for proper placing within his territory. He is guided by the blueprint of the floor plan, and is aided further by the chalked out spaces on the floor which indicate the exact area to be occupied by the furniture. By reference to the tags on a piece of furniture he identifies it, and reference to the floor plan shows where it goes. As fast as the furniture is put in position it is checked off on the blueprint.

Proper placing involves also the placing of the bundles of papers and desk material on the desks which they belong.

Weigh Material On the Move



With the MERRICK CONVEYOR WEIGHTOMETER

The Merrick Weightometer weighs conveyor handled material while the products are in transit. It does this without any additional handling or additional cost in time and labor.

Hundreds of concerns now check materials and products they buy and sell with the Merrick Weightometer. It is being used for various materials, such as, coal, coke, gravel, stone, cement, phosphate, fertilizer, fish, ores, etc.

No Weighman or Attendant Needed
Accuracy Guaranteed 99%

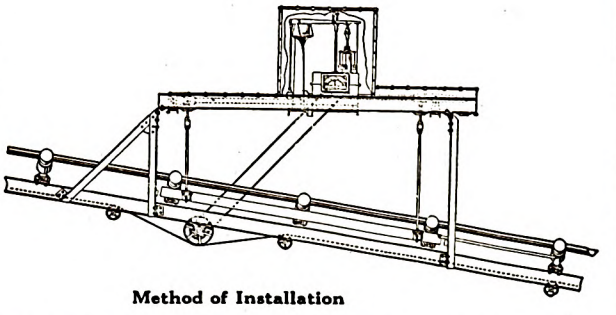
The Merrick Weightometer records the weights of materials as they are carried along on the conveyor without interrupting the flow.

The Weightometer shows you exactly how much material you receive—how much material you ship or gives a check on mill processes.

Why depend on Bill of Lading Weights?

Let us show you the money saved in labor and time with the Merrick Weightometer.

Send for "Merrick circulars" they explain in detail the advantages of the Merrick Weightometer. Write for them today.



Method of Installation

MERRICK SCALE MFG. CO.,

180 Autumn Street, PASSAIC, N. J.

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"We've Been Wanting Better Brooms!"

"The old wire bound brooms we have been using don't give the service. But this RED CAP Broom looks like a REAL BROOM. I'll bet it will save us a lot of money in cleaning costs. It seems to be built RIGHT, and the guarantee shows that the maker has confidence in it. I'll order a trial dozen RED CAPS today from our jobber and test them out."

Thus one more purchasing agent finds the way to secure better cleaning results at lower cost. Ordinary brooms will not meet the strenuous demands of industrial cleaning, but RED CAP Brooms are built especially for that extraordinary service. Wherever used, RED CAPS are successful in saving time, labor and money.
That superiority is found throughout the entire line of

CAPITAL
Industrial Brooms and Brushes

"Red Cap" Brooms are built in a wide metal case, nailed from each side with wrought iron nails, with an extra metal re-inforcing band and sewed with heavy waxed twine. The materials are carefully selected corn and split bamboo, all-corn, or corn and soft, round rattan.



Each item in the line—floor brushes, push brooms, bench dusters, etc.,—is designed to meet a particular industrial need. We devote our entire facilities to making industrial cleaning equipment, and years of development have made the CAPITAL Line the best on the market.

Order from Your Jobber Under Our Guarantee

Jobbers everywhere sell CAPITAL Brooms and Brushes. Your own mill supply or hardware jobber is probably our representative. From our Catalog 17, sent on receipt of the coupon below, you can select the brooms and brushes that meet your requirements. Your jobber will furnish them under our guarantee, which permits you to return any unsatisfactory goods for full credit, carrying charges both ways paid by us.

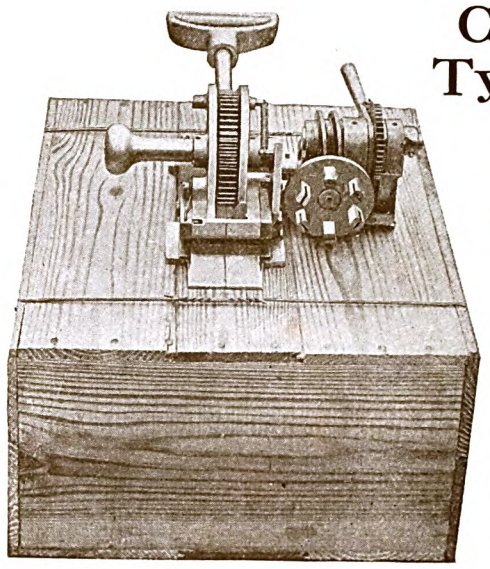
Send for Catalog 17 Today—Use the Coupon

INDIANAPOLIS BRUSH & BROOM MFG. CO.
I. W. LEMAUX, President
130 Brush Street Indianapolis, Ind.

MAIL THIS COUPON

Indianapolis Brush & Broom Mfg. Co.,
130 Brush Street, Indianapolis, Ind.
Send us Catalog 17, and the name of your nearest jobber.

Name.....
Address.....



CARY'S Seal Tying Machine

The sturdiest and most efficient machine ever devised for the application of wire bands at any desired tension to all kinds of boxes, crates, etc.

Simple but Positive

in operation. Fool-proof and built to stand hard service. Weighs only 14 pounds.

The manner in which the wire is automatically sealed insures maximum strength and leaves no sharp ends to protrude and cause damage.

CARY'S Capped Bundled Wire



The wire with the patented shoulder

The Only Perfect Wire for Use in any Wire Tying Machine

A special drawn round galvanized wire in 13 and 14 gauge. The 13 gauge wire is packed in bundles containing 250 pieces; 14 gauge, 400 pieces in a bundle. Furnished in any length desired.

The patented shoulder holds the wire securely in any tying machine and absolutely prevents slipping. This is an exclusive feature.

Our method of bundling insures every wire being in perfect condition when received by you.

Prices and discounts furnished on application

CARY MANUFACTURING CO.
Manhattan Bridge Plaza Brooklyn, N. Y.

MARBLELOID
The Universal FLOORING for Modern Buildings

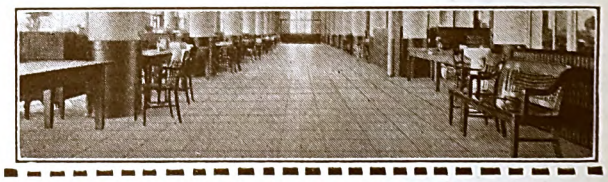
Have you in any office or industrial building a worn floor which needs renewing?

If you have such a floor, the properties of Marbleloid fireproof flooring should interest you—because it is an ideal material for re-surfacing old floors whether they are wood or concrete.

This composition flooring is laid plastic over the old floor and in a few hours you have a strong, warm, smooth-surfaced, modern floor which adds much to the appearance, serviceability and permanence of your building. This Marbleloid Floor will not dust or chip, will be found certain and elastic for walking and will not require any expensive upkeep.

We install each Marbleloid floor as well as manufacture the material and we will guarantee it to please you in attractiveness, longevity, warmth, strength and in all other qualities we claim for it. Let our engineers give you practical floor facts and send floor book. *Use handy coupon below.*

THE MARBLELOID CO., 467 Eighth Ave., N. Y.



THE MARBLELOID COMPANY, New York City: Without obligating myself in any way, please submit tentative estimates on the cost of your product installed complete for our building.....
.....: below are the approximate areas involved.

Floor.....Sq. Ft. Sanitary Base.....Lineal Ft.

Wainscot.....Sq. Ft. I have checked the floor troubles we now have.

Our floors are

[ ] New Concrete [ ] Cement Finish [ ] Wood
[ ] Cracking [ ] Cold [ ] Slippery
[ ] Dusting [ ] Splintering [ ] Unsanitary
[ ] Noisy [ ] Rough [ ] Rotting

Name.....
Firm.....
Address.....
[ ] Please send 32 page Illustrated Booklet

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Handling Materials in a Book Bindery

(*Continued from page 13*)

unit which is nothing more than an ingenious clamping device. The books are built into press over a heavy board, slotted at both ends; when the press is filled a top board also slotted is inserted, pressure applied, clamping rods slid into the slots, tightened, pressure released, the entire contents of press slid out on a specially designed truck and the press is ready for another filling. This cuts our actual presses and the floor space they use down to seven (from sixty) and enables us to use as many individual units as we desire without increasing the actual presses. We use over one hundred equipments now.

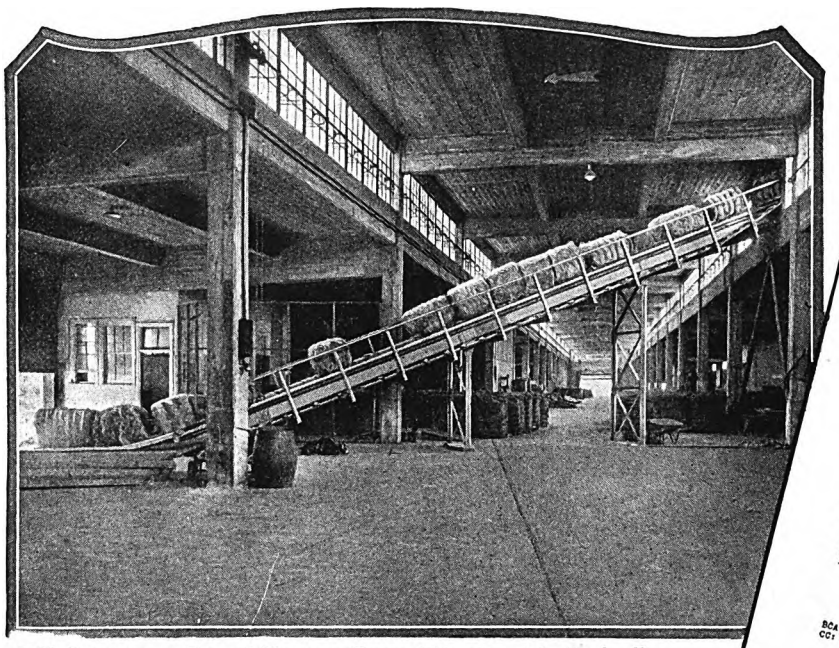
These same press trucks save a handling for they are pushed up to the examiners' tables and unloaded directly to the tables instead of first onto a platform and then onto the table. They also provide storage space and are the transporting medium for the pressing boards used between the rows of books.

The material handling problem is a serious one. Books, whether in the flat, partially worked or completed state are bulky, as a rule heavy and easily "spilled." The platform unit elevating truck principle is the logical solution of this problem in a book bindery. Few persons know that the elevating truck principle was evolved years ago in our plant and was a direct result of our efforts to solve the handling problem of book stock and flat printed matter. It is interesting to recall this now that so many different elevating trucks are available. One will be immediately struck by the simplicity of our industrial truck mechanism. The outstanding feature is the height of the platform. An employe, as determined by actual tests, can pick up or deposit a greater load at each effort eleven or fifteen inches from the floor than at six or eight.

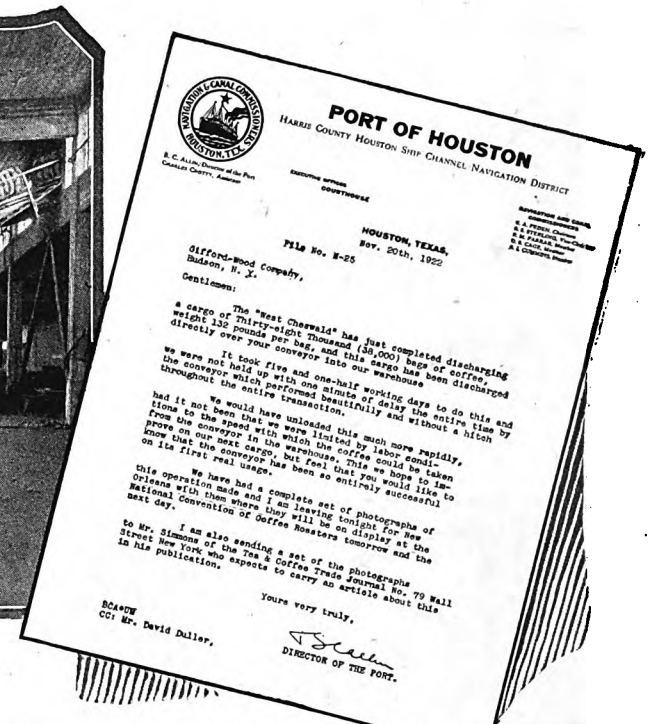
We use two units, one 26″ x 32″ for all folded signatures, gathered or otherwise completed books and heavy materials, and another 41″ x 61″ for flat printed sheets, wrapping and other paper stock. These two are standard and all our trucks fit these two platform sizes.

The efficiency of this movable platform needs no explanation. Any plant, no matter what it manufactures, that continues to pile material on the floor or use old style trucks necessitating obvious rehandling, is losing a good round profit each year and not realizing it.

Facilitating prompt, rapid handling with least effort, of incoming and outgoing shipments is another problem. By arranging our truck receiving spaces so that the truck platforms are level with the shipping floor enables us to load our trucks with these same movable platforms in many instances, saving another



G-W Conveyor at Port of Houston, Texas. Side view of incline leading from wharf to bridge spanning warehouse and wharf. 22 degree incline. Capacity—125 tons per hour.



PORT OF HOUSTON
HARRIS COUNTY HOUSTON SHIP CHANNEL NAVIGATION DISTRICT

HOUSTON, TEXAS,
Nov. 20th, 1922

File No. H-25

Gifford-Wood Company,
Hudson, N. Y.

Gentlemen:

The "West Cheswald" has just completed discharging a cargo of Thirty-eight Thousand (38,000) bags of coffee, weight 132 pounds per bag, and this cargo has been discharged directly over your conveyor into our warehouse.

It took five and one-half working days to do this and we were not held up with one minute of delay, the entire time by the conveyor, which performed beautifully and without a hitch throughout the entire transaction.

We would have unloaded this much more rapidly, had it not been that we were limited by labor conditions to the speed with which the coffee could be taken from the conveyor in the warehouse. This we hope to improve on our next cargo, but feel that you would like to know that the conveyor has been so entirely successful on its first real usage.

We have had a complete set of photographs of this operation made and I am leaving tonight for New Orleans with them where they will be on display at the National Convention of Coffee Roasters tomorrow and the next day.

I am also sending a set of the photographs to Mr. Simmons of the Tea & Coffee Trade Journal No. 79 Wall Street New York who expects to carry an article about this in his publication.

Yours very truly,

DIRECTOR OF THE PORT.

BCA:HW
CC: Mr. David Duller,

Gifford-Wood Conveyor Saves at Port of Houston, Texas

It replaces costly manual labor and speeds up transfer of sacked and baled goods from wharf to second floor of warehouse.

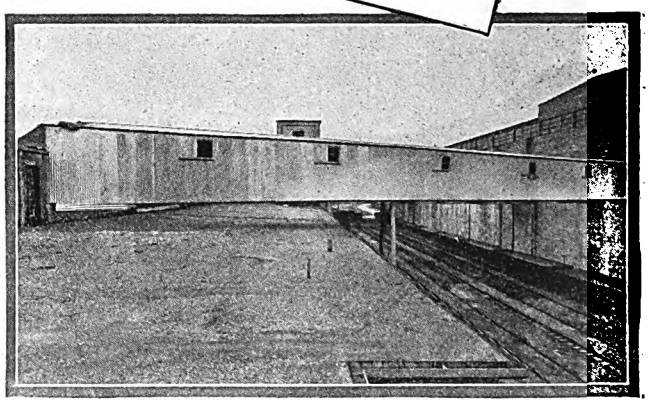
"The 'West Cheswald' has just completed discharging a cargo of 38,000 bags of coffee, weight 132 pounds per bag, and this cargo has been discharged directly over your conveyor into our warehouse.

"It took five and one-half working days to do this and we were not held up with one minute of delay, the entire time by the conveyor, which performed beautifully and without a hitch throughout the entire transaction.

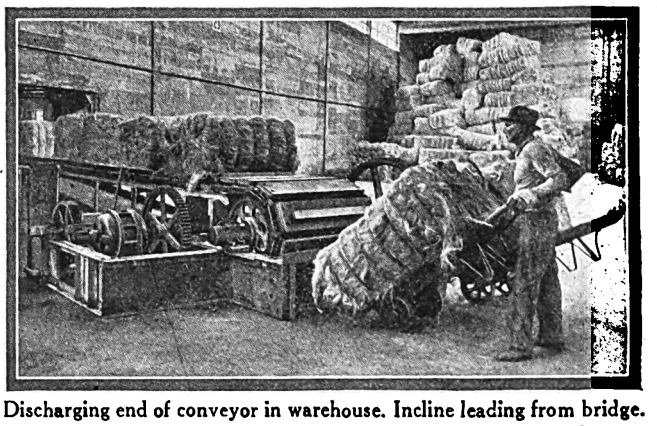
"We would have unloaded this much more rapidly, had it not been that we were limited by labor conditions to the speed with which the coffee could be taken from the conveyor in the warehouse. This we hope to improve on our next cargo, but feel that you would like to know that the conveyor has been so entirely successful on first real usage." (November 20th, 1922.)

B. C. ALLIN, Director of the Port

G-W Elevating and Conveying Machinery is built for economically handling all kinds of goods and materials—sacks, bales, boxes, packages, cans, coal, ashes, etc. Write our nearest office for a G-W Catalog.



Conveyor bridge spanning wharf and warehouse. 120 feet long. Built of steel, with corrugated siding on top, sides, and bottom.



Discharging end of conveyor in warehouse. Incline leading from bridge. 25H. P. motor drive. Conveyor speed—60 F. P. M. Reversible.

MAIN OFFICE & WORKS: HUDSON, N. Y.
New York: 50 Church St. Boston: 24 Milk Street
Chicago: 565 W. Washington St. Buffalo: Electric Building.

Gifford-Wood Co. BUILT STRONGER LASTS LONGER

MATERIAL HANDLING EQUIPMENT

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handling. We receive flat sheets from other plants through having similar facilities at both establishments. These truck spaces also provide garaging, and electric plug connectors from the generator room charge our electric trucks while loading, unloading, or while stored at night.

The car shipping problem is solved by a seven car siding within the building, the car floors being level with the platform. Enclosed compartments along the platform permit separating different materials or customers' property.

The by-product problem in a bindery is simple. It consists principally in selvedge rolls from book cloth which are rerolled and sold by the pound to tablet, blank book, copy book and calendar manufacturers; the off-cuts of leather skins, such as sheepskin, cowhide and goat (morocco) which we work up into specialties such as card-cases, desk-pads, etc., or dispose of to pocketbook and novelty houses.

The waste problem is not so easily disposed of. Books are printed on all sorts and colors of paper. Some papers are the cheapest of wood pulp base, others have a certain percentage of rag content, while the finest papers appear seldom and in small quantities. To sell all the trimmings from these thousands of books a day (about 7,500,000 a year) as one class of material places it all in the class of the cheapest ingredients used. To sort it into all the divisions possible would be unwise because of the expense.

By keeping it in four classes, separating it by the simple expedient of providing metal waste trucks into which the operators on the different cutters throw their waste, and depositing it by means of a gravity chute from the fourth floor to the baling room in the basement into numbered trucks for each class of waste, nets us a saving of several thousand dollars a year.

A further increase in sales of fabricated structural steel is reported for February, according to figures received by the Department of Commerce through the Bureau of the Census. February sales amounted to 80 per cent. of shop capacity as against 76 per cent. for January. Total sales reported for February by 151 firms, with a shop capacity of 219,955 tons per month, amounted to 176,787 tons, the highest since last May.—*Department of Commerce.*

For photographs in this issue, not otherwise credited, we are indebted to the courtesy of the following:

CHOOSING THE ELECTRIC MOTOR FOR THE JOB
The General Electric Co.

HANDLING MATERIALS IN A BOOK BINDERY
The J. F. Tapley Co.

IS THE FIELD FOR GASOLINE TRACTORS LIMITED?
Clark Tructractor Co.
Cleveland Tractor Co.
Hellman Motor Corp.
Holt Manufacturing Co.
Hyatt Roller Bearing Co.
Reliance Trailer & Truck Co.
Towmotor Co.

PREPARATION AND BURNING OF PULVERIZED COAL
Aero Pulverizer Co.
Bonnot Co.
Fuller-Lehigh Co.
Pennsylvania Crusher Co.

AUTOMATIC LUBRICATION
S. F. Bowser & Co.
De Laval Separator Co.
Detroit Lubricator Co.
Ingersoll-Rand Co.
Lunkenheimer Co.
B. F. Sturtevant Co.
Wolf Co.

MANAGING THE MOVE
Leffingwell-Ream Co.

SAVE $1,000.00 ON YOUR LIGHT BILL

Does your Electric Lighting Bill run $3,000 yearly?
You can lop off 1-3 of it (a cool thousand) if you will install the nearest approach to ideal light yet devised.

Anderson Self-Adjusting Arms for LOCALIZED LIGHTING



Anderson adjustable lighting fixture over sewing machine installation in C. G. Gunther's Son's, Furriers, N. Y.

By one movement the light can be instantly adju ted, within a fraction of an inch, to focus directly on the job—no chance for light to be wasted. It's shining with full brilliancy right where it is needed—**on the job.**

Always appreciated by the workers who can handle their tasks with less strain and in shorter periods.

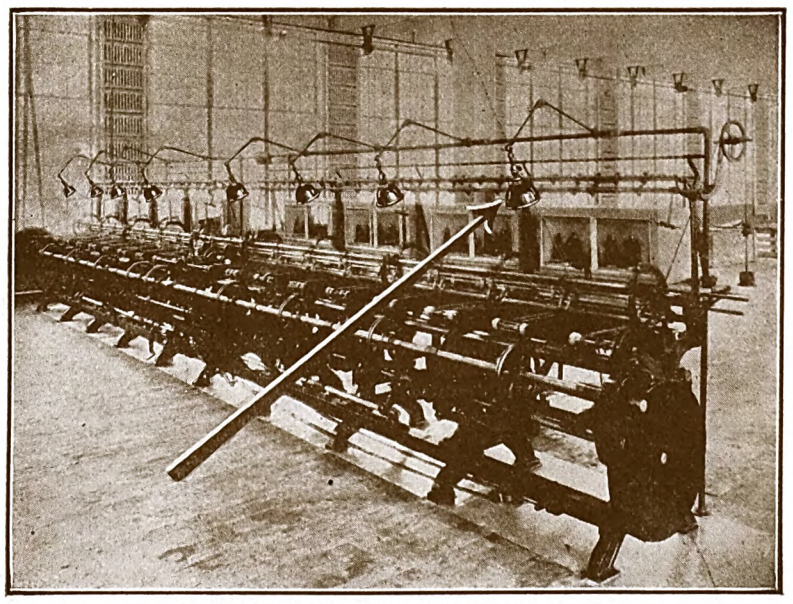
In plants where Anderson Localized Lighting system has taken the place of the antiquated methods of "lighting the whole factory to thread a needle" working efficiency has been increased 10% to 25%.

Adopted for installation in every type of industry where localized lighting is employed.

Some of our Users

General Electric Co.
C. G. Gunther's Sons
American Car and Foundry Co.
Brown Shoe Co.
American Steel Foundries Co.
Cluett Peabody & Co.
Commonwealth Edison Co.
Ingersoll Rand Co.
Lincoln Motor Co.
Studebaker Corporation
Pennsylvania System
New York Globe
Brooklyn Eagle
Philadelphia Inquirer
Brown Lipe Gear Co.
Dodge Brothers Motor Cars
Goodyear Tire and Rubber Co.
Taunton Knitting Co.
Carnegie Steel Co.
Cambria Steel Co.
Bessemer Steel Co.
Sun Ship Building Co.
Sweet-Orr Overall Co. (seven plants)
Curtis Publishing Co.
Baldwin Locomotive Works
Knox Hat Company
American Can Co. (three plants)
Savage Arms Corp.
Remington Arms Co.
Submarine Boat Co.

If you use light, use **Anderson Self-adjusting Arms** and cut out waste.



Installation in one of Paterson's (N. J.) Silk Mills.

A demonstration by our lighting engineer costs you nothing but the request. Send for list of plants in your direct line of business that we have already equipped.

Localized Lighting Corporation

of American Electric Equipment Co., Inc.

Room 1216 **Longacre Bldg., 42nd St. & B'way., New York**

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Power without fuel problems

A Perfected Oil Engine for Industrial Purposes

Power production for many purposes need no longer be burdened with costly and uncontrollable coal problems. The Fulton-Diesel has proved the high economy of a perfected means to use low-grade fuel oil in internal combustion. Fuel is always available—and pipe-line, rail and truck transportation insure deliveries against interruption.

The strongest endorsement of Fulton-Diesel efficiency is found in the fact that, in many instances, the performance of one has led to the purchase of another. Side by side you find them in ice plants, flour mills, mines, cement plants, central stations, waterworks, oil pipe-line stations, etc.

The Fulton-Diesel is an American built, stationary, internal combustion oil engine, suited to a wide range of industry. It operates on one-third of the fuel required to produce equal steam power. There are no stand-by losses, no delay in starting, no ash removal expense. Labor is reduced to one engineer. The whole cycle of power generation is in the single unit—saving investment in boilers, stacks and other steam plant auxiliaries.

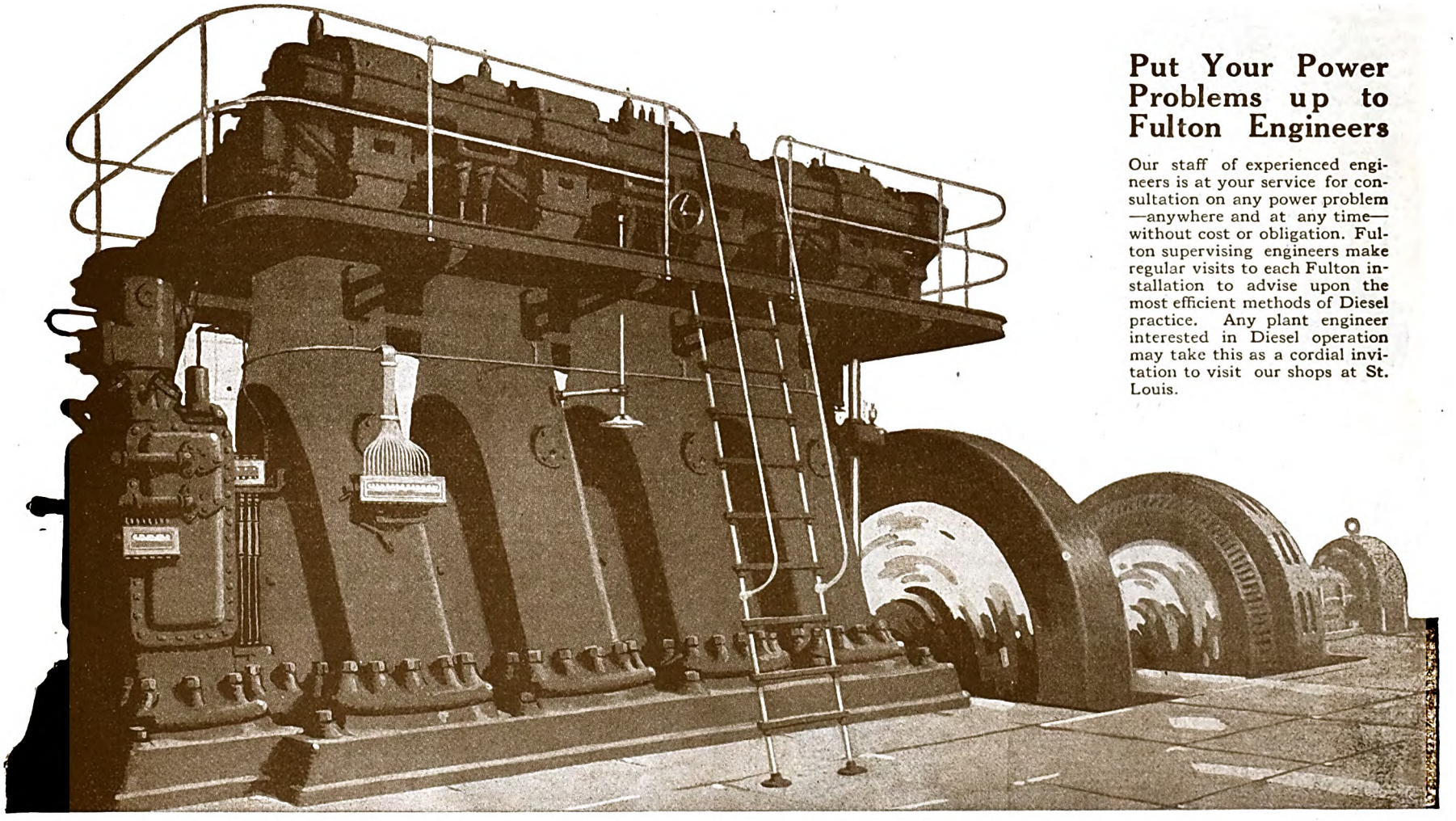
The Fulton-Diesel is a product of 70 years successful engine building. By its mechanical efficiency it achieves the highest degree of power economy yet developed in a prime mover, through the elimination of so many factors contributing to power waste.

The story of the Fulton-Diesel is one of the most important before American industry today. You only have to ask for us to send you—free and postp aid—a copy of our carefully written and fully illustrated booklet, describing the Fulton-Diesel in detail.

FULTON IRON WORKS COMPANY, ST. LOUIS, U. S. A.

Successful Engine Builders for 70 years

Branch Offices: New York - 82 Wall St. Dallas, Texas - Praetorian Bldg. New Orleans - Hibernia Bank Bldg. Havana, Cuba - 402-403 Banco Nacional



Put Your Power Problems up to Fulton Engineers

Our staff of experienced engineers is at your service for consultation on any power problem—anywhere and at any time—without cost or obligation. Fulton supervising engineers make regular visits to each Fulton installation to advise upon the most efficient methods of Diesel practice. Any plant engineer interested in Diesel operation may take this as a cordial invitation to visit our shops at St. Louis.

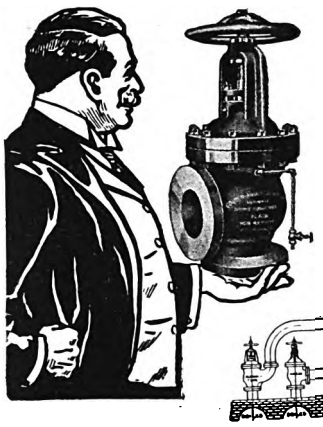
FULTON DIESEL

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Why did the large Steel Corps. Install 4100 GOLDEN ANDERSON

Life and Property Insurance Valves?

"There Must Be a Good Reason"



And there certainly is

Golden-Anderson Valves are a Gilt-edged Investment in safety.

"No Shut-Down When a Boiler Tube Ruptures"

"No Explosion When a Steam Pipe Bursts"

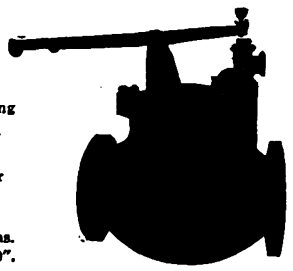
DOUBLE EXTRA HEAVY VALVES

"Every Valve sold with a Positive Guarantee."

1. They will cut off a boiler instantly when a boiler tube bursts.
2. They will prevent live steam from entering a cold boiler, thus insuring safety to workmen.
3. They instantly shut off the steam from all boilers when a pipe breaks.
4. They can be opened or closed by hand in the same manner as ordinary gate or globe valves when fitted with the patented safety latch.
5. Double cushioning prevents absolutely all pounding or chattering.
6. Automatically equalize the pressure between all boilers.
7. Are equipped with double Corliss Dash Pot that cushions it opening and closing.
8. Cannot pound, spin, stick or chatter.
9. Every valve sold with a positive guarantee.
10. Safeguard the men and safeguard the property.

GOLDEN-ANDERSON

Pat. Automatic Cushioned Stand-Pipe Valves



Especially adapted for coke quenching

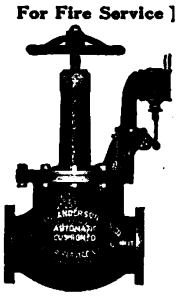
No metal-to-metal seats

Air and water cushioned

Angle and Globe patterns. Sizes 3" to 30".

GOLDEN-ANDERSON

Cushioned Electric Water Service Valves For Fire Service



No waste of current as it is only on solenoid a few seconds on either opening or closing of valve.

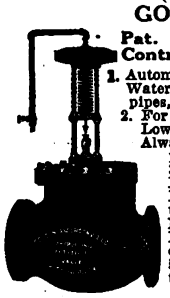
May be closed and opened from remote points electrically; also hand operated.

Air and water cushioned. No metal-to-metal seats. Virtually indestructible.

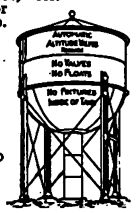
Sizes to 30 in.

GOLDEN-ANDERSON

Pat. Cushioned Automatic Controlling Altitude Valves



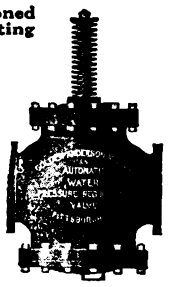
1. Automatically Maintain uniform Water Levels in Tanks, Standpipes, Reservoirs, etc.
2. For High or Low Pressure. Always Dependable.
3. No Floats or Fixtures used.
4. No Water Hammer or Shocks.
5. Sizes up to 30 in.



GOLDEN-ANDERSON

Pat. Automatic Cushioned Water Pressure Regulating Valves

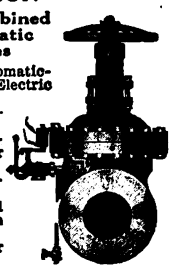
1. Maintain a constant reduced pressure regardless of fluctuations on high pressure side.
2. Perfectly Cushioned by water and air. No metal-to-metal seats.
3. The best valve made for maintaining a constant low pressure where consumption is continuous.
4. Operates quickly or slowly as required—No attention necessary.
5. Positively no hammering or sticking. Sizes to 24 in.



GOLDEN-ANDERSON

Pat. Cushioned Combined Throttle and Automatic Engine Stop Valves

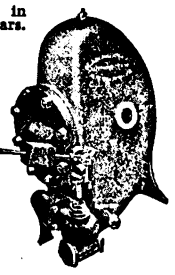
1. Operate 3 ways: Automatically, by Hand, or by Electric Switch.
2. Prevent Fly-wheel Explosions.
3. "Double Corliss" Cushioned—No Pounding or Sticking.
4. Contains No Tight Fitting Parts.
5. Furnished in Angle and Globe Patterns for High or Low Pressures.
6. "Always Ready for Service."



GOLDEN-ANDERSON

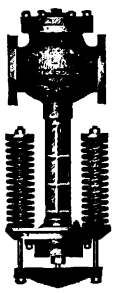
Patent Automatic High and Low Pressure Steam Traps

1. The first new departure in steam trap design in years.
2. 50 to 100% greater capacity than other traps of similar size.
3. Full area through discharge valve.
4. Extra Heavy Throughout — Very Durable — Will last a lifetime — and Always Works.
5. Furnished Semi-Steel and Cast Steel for Superheat.



GOLDEN-ANDERSON

Pat. Automatic Cushioned Steam Pressure Reducing Valves



1. Maintain a constant reduced pressure.
2. Thoroughly cushioned.
3. No hammering, chattering or sticking.
4. No auxiliary valves or small by-passes to clog up.
5. No wire drawing.
6. Only one adjustment from the outside.
7. Double extra heavy throughout—practically indestructible.

GOLDEN-ANDERSON

Pat. Automatic Double Cushioned Check Valves

1. Especially adapted for Water Service.
2. For High or Low Pressure.
3. Thoroughly Cushioned. No chattering, Hammering, or sticking.
4. Globe or Angle Patterns up to 30 in.
5. Especially adapted for hydraulic elevator service.



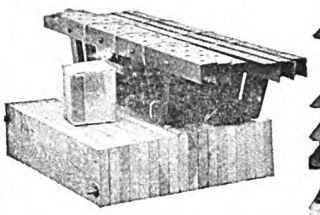
Golden-Anderson Valve Specialty Co.

1306 Fulton Building **Pittsburgh, Pa.**



At Right:—An Enterprise Platform loaded with 5000 pounds of pig iron.

Below:—Three Enterprise Platforms ready for shipment, showing why they take a class three freight rating.



Shipped Anywhere at Low Cost

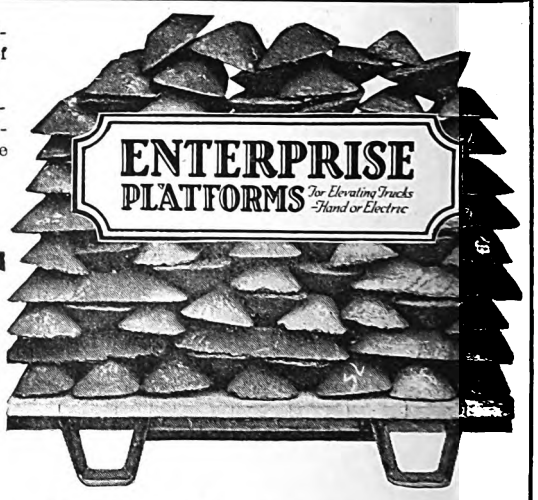
Enterprise Platforms can be shipped anywhere at an exceptionally low cost. They come to you knocked down—take a class three freight rating, which means a substantial saving on the shipping cost. But everything is complete, and easily assembled in a few minutes. Necessary bolts, nuts and lock washers are supplied. Top boards finished on four sides, cut to length, bored and countersunk for bolts.

Made in all Sizes

If you will give us the following information we will quote you promptly on a platform to meet your requirements.

Measurements Desired

Length of top over all.....
Width of top over all.....
Clearance between runners....
Style elevating truck used ....
Height of truck base when lowered .....



Carry Heaviest Loads

ENTERPRISE PLATFORMS wont break down under heavy loads like the all-wood platforms you make. The combination wood and steel construction of Enterprise Platforms makes them so strong and durable that they carry the heaviest loads—practically eliminate the expense of repairs or replacements—and last indefinitely. Enterprise Platforms are built *so strong*, and they cost *so little*, you can't buy or make platforms of equal strength and durability for less money. Send measurements and get descriptive literature and prices.

ENTERPRISE IRON WORKS

1156 E. 24th St. **Indianapolis, Ind.**

ENTERPRISE PLATFORMS *For Elevating Trucks -Hand or Electric*

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Choosing the Electric Motor for the Job

(Continued from page 11)

accelerate heavy loads.

Next to the shunt motor in adaptability for driving various types of machines and other industrial drives, is the compound motor. This motor, as its name implies, is a combination of the shunt motor and the series motor. It has two field windings, one shunt and the other series, which give it the high torque characteristics to a certain degree, of the series motor. As a matter of fact, it may be said to combine the good features of both. This type of motor is employed very extensively in shop practice, for driving punch presses, bending rolls, and metal forming machinery in general. It is also used in rolling mills for auxiliary drives, on elevators, and in other places where intermittent high torque service and safe, light load speeds are required.

A good example of compound motor drive is that of the belted metal planer. The duty cycle of planers requires frequent and rapid reversals, with the motor overloaded at the instant of reversal, and the speed must remain fairly constant under load conditions. The load is usually applied very suddenly on the "cut stroke," and is as suddenly removed.

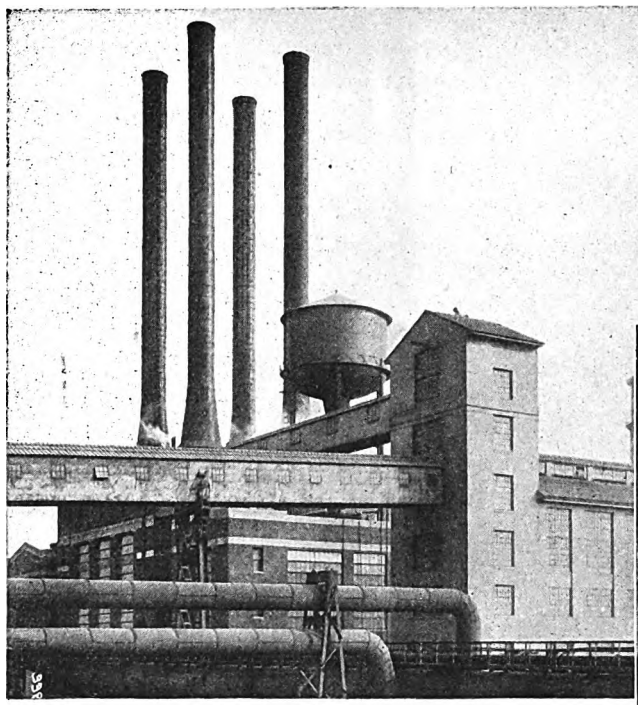
Alternating current as a form of power supply has been more widely used than direct current for industrial purposes. There are, with alternating current, factors affecting the correct choice of types of motors for a given work that do not exist with direct current. The most important of these from the standpoint of operating economy, at least, is power factor. This has assumed added importance because of the growing tendency of central stations to include penalty bonus clauses in their power contracts. In other words, the factory with poor power factor conditions pays more for a given amount of power at the meter than one where the power factor is good. How advantage can be taken of this situation by the selection and application of the various alternating current motors will be seen from a consideration of their characteristics.

Of the three types of alternating current motors, induction, synchronous and series, the induction motor is the most popular. The induction motor class is divided, according to the certain operating principles of the motors themselves, into squirrel cage motors and wound rotor motors. Each of these has characteristics as to speed, torque and efficiency peculiar to itself.

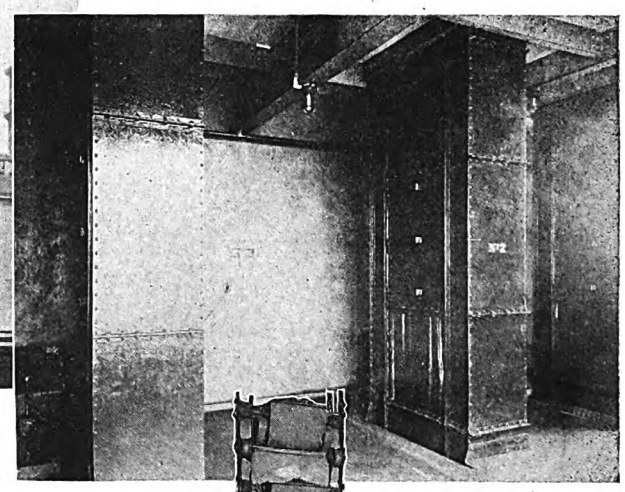
The rotation of the induction motor is brought about by shifting of the magnetic field produced in the stator winding, which as it shifts, drags the rotor around with it. The speed is therefore dependent on the frequency of the current supply. The squirrel cage motor has a relatively low

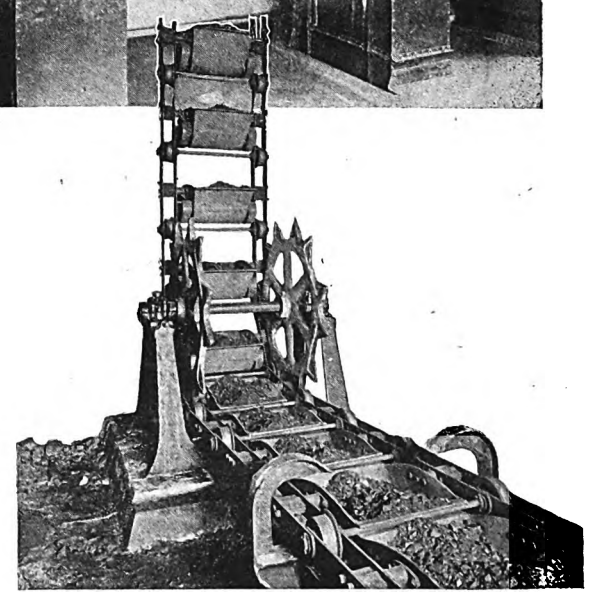
(Continued on page 61)

In the Coal Pulverizing Plant at River Rouge



Jeffrey Pivoted Bucket Elevator Conveyor





The economy and efficient performance of Jeffrey Conveying Equipment is very evident at the Ford River Rouge Plant.

Here in the pulverizer building 250 tons of coal per hour are ground into boiler fuel. It is then conveyed through the pulverizer building up to the tower by a Jeffrey Pivoted Bucket Carrier on to the cross conveyors into the boiler room.

In the Ford Plant and in hundreds of industrial power plants Jeffrey Equipments are important factors in lowering the cost of generating power.

Our Engineering experts are at your service and will gladly assist you in the selection of equipment applicable to your requirements. Send for our catalog, No.345. It will help you towards lower power plant costs.

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MATERIAL HANDLING MACHINERY

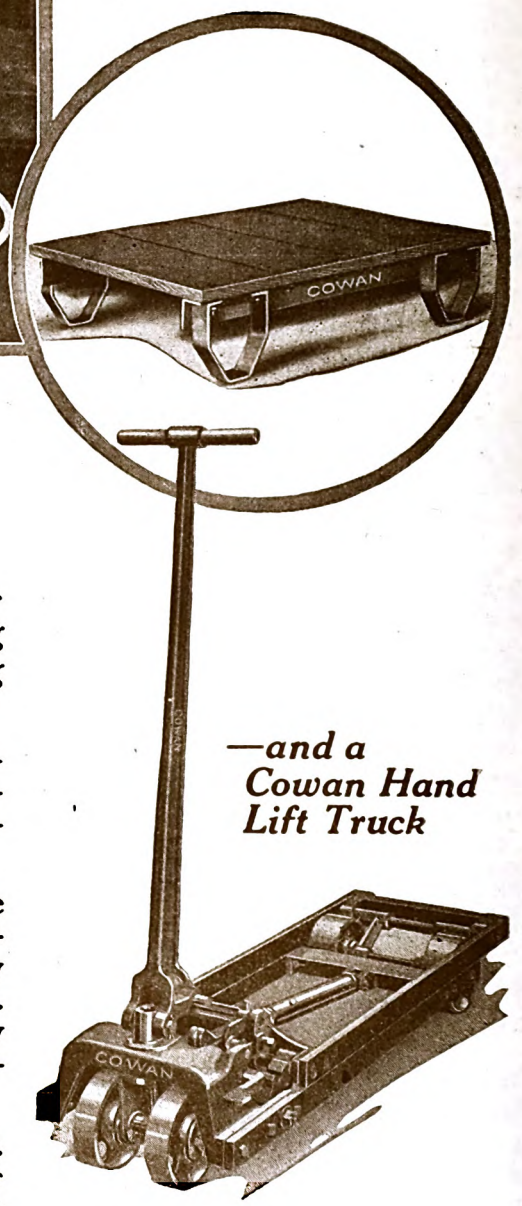
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ELIMINATE REHANDLING



He runs the Cowan Hand Lift Truck under the loaded skid and with a single downward sweep of the handle elevates the truck platform, quickly and easily picking up the skid and its load. At destination, he steps on the foot pedal and skid and load are quickly and gently lowered to the floor.
No loading and unloading by hand—wasteful in time, labor and money. No truck delay. *One* man instead of a gang.

Cowan Skid Platforms for Your Loads



—and a Cowan Hand Lift Truck

HOW many times are your goods and materials loaded and unloaded by hand in moving them from point to point? Each rehandling wastes time, labor, and money.

The Cowan Hand Lift Truck and Skid System has eliminated costly rehandling and greatly reduced truck equipment investment and maintenance for thousands in practically every line of business.

One man and a *single* Cowan Hand Lift Truck often serve as many as fifty to one hundred skid platforms—duplicating the work of an extensive equipment of ordinary trucks and the force of men necessary to handle them. Cowan Long-Life Skid Platforms are strong, sturdy, simply constructed, and inexpensive. Their maintenance is practically negligible.

Eliminate rehandling. Send for a Cowan System expert. Without obligating you in any way he will analyze your material handling problem and fully explain how the Cowan System can reduce your material handling costs. Or write, briefly describing the materials you handle, and we will gladly mail information pertinent to your particular business.

The Cowan System includes Cowan Hand Lift Trucks, Long Life Skids, Electric Lift Trucks, Electric Load Carrying Trucks, and Electric Tractors—used individually or in combination.

COWAN TRUCK CO., 6 WATER ST., HOLYOKE, MASS.

New York Office: Grand Central Palace. Offices in Principal Cities

Largest manufacturers of complete Hand and Electric Industrial Truck Systems.

COWAN INDUSTRIAL TRUCKS-TRACTORS

Originators *of the* "through ticket" *system for* moving loads

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(*Continued from page 59*)

starting torque, and draws a heavy starting current from the line. Ordinarily it is used for drives where the duty cycle calls for a constant speed and infrequent starting. Such applications as certain small machine tools that run continuously, fans, blowers, etc., are good examples. Since there is no mechanical or electrical connection between the stator and the rotor, and consequently no sliding parts to cause sparks, this motor is adapted for the use in places where fire hazard from dust or fumes in the surrounding atmosphere is to be considered—in flour mills, for example. A form of squirrel cage motor known as the "cast rotor" type has been developed, which has been applied very successfully to wood working machinery, and other places where a very high constant speed is desired. Motors have been built for this work that develop speeds as high as 25,000 R. P. M. It is possible to fit an induction motor of some sort to almost any kind of work.

In another form, known as the multi-speed type, the speed is changed by altering the number of poles in the primary, or stator. Such motors are used in sizes up to 4,000 HP for driving mills in steel plants, for propellor drives on electrically driven battleships, and industrially for all sorts of machine tools, line shafts, textile machinery, rubber mill machinery, etc.

The wound rotor or slip ring induction motor has a large field of application, owing to its high starting torque. In fact, this motor corresponds in characteristics and field of application to the compound wound direct current motor. It may be built for variable speeds. In variable speed motors the speed is changed by altering the resistance in the secondary or rotor circuit. Like the D. C. compound or series motors, the speed obtained with resistance in the rotor circuit depends on the load, and it is not considered good practice to operate at less than 50 per cent speed with full load torque.

Care must be used, however, in selecting the motor or motors for any particular drive, whether group or individual, because of their power factor characteristics. The induction motor, when operated at partial load, has a very poor power factor, and a number of them on the lines of a factory will adversely affect the overall power factor. This feature can be overcome, in the case of group drive, by so apportioning the duty of the individual machines in the group that a motor of such horsepower can be used that it will run at the point in its load curve that insures the best power factor. This usually means between ¾ and full load. In the case of individual drive, the motor should be selected so that its horsepower is sufficient to meet ordinary demands of the driven machine and shut down when the machine is not in operation, which will insure a good load and power factor. In other words, "overpowering" the machines should be avoided.

The synchronous motor, because of its high power factor, has received increasing attention from engineers and large

(*Continued on page 63*)

SKF



Deep-Groove Ball Bearings

Easily Withstand Exacting Duty on Pumps

LOCATED far away from industrial centers and in localities difficult of access, oil-well pumps must be kept in operation despite possible neglect and the inability to obtain prompt repair service.

Most of the responsibility of protecting pumps from breakdown, falls upon the bearings which must accept the heavy radial and thrust loads without developing any radial or axial play that would endanger the rotating members.

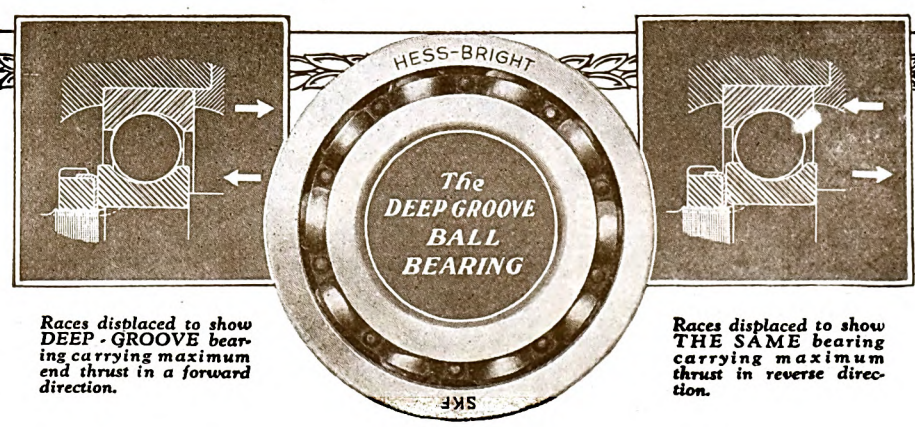
Deep-groove ball bearings made by the Hess-Bright Manufacturing Company shoulder this responsibility with ease for, unlike sleeve types of bearings, they develop no appreciable wear in service. Furthermore, they take heavy thrust loads in combination with radial loads and thus eliminate the common difficulties experienced with step thrust bearings.

Because of these advantages ball bearings have met with wide adoption on not only oil-well, cargo, fire-fighting and city water supply pumps but on all classes of machinery containing rotating elements.

THE HESS-BRIGHT MANUFACTURING COMPANY

Supervised by SKF INDUSTRIES, INC., 165 Broadway, New York City

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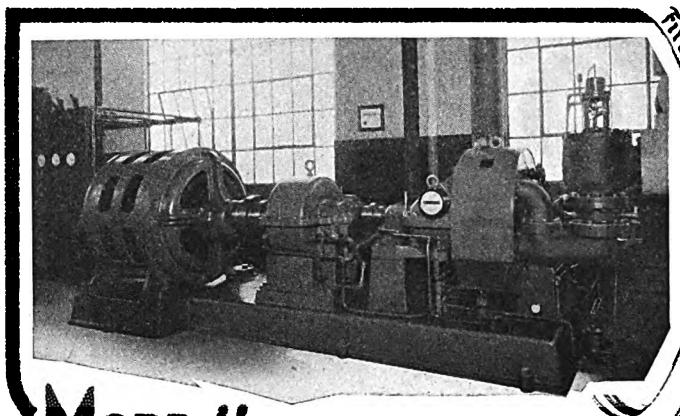
Races displaced to show DEEP-GROOVE bearing carrying maximum end thrust in a forward direction.

Races displaced to show THE SAME bearing carrying maximum thrust in reverse direction.

BALL BEARINGS

The Highest Expression of the Bearing Principle

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MORE *than* JUST A POWER UNIT

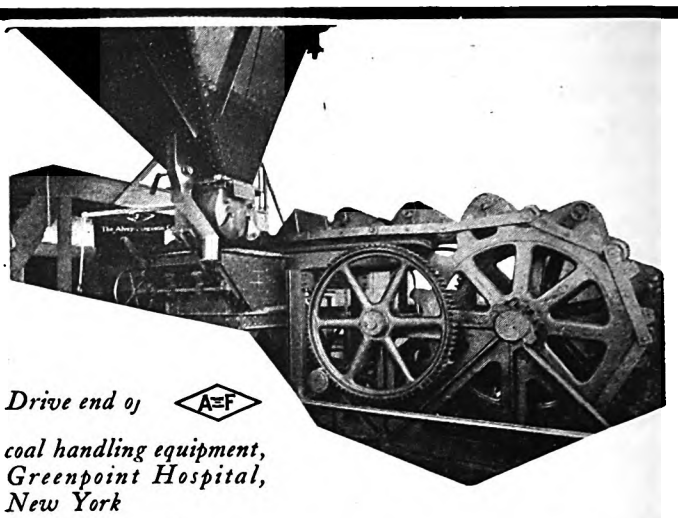
It is a power extracting reducing valve, a heat balance regulator with a "brain" all its own, furnishing always the exact amount of exhaust steam required for heating, and last, but most important, a paying investment earning as much as two hundred dollars a day.

THE Firestone Metal Products Co. in Akron, Ohio, had a problem no different from many other plants, but they solved it in a different way. Low pressure steam was required for heating in such varying quantities that a reducing valve would have been the usual solution. But they installed a highly efficient 1000 H. P. four-stage Terry turbo-generator unit. This not only gave them the desired pressure reduction but also extracted the power from the pressure drop. As the demand for the exhaust steam varied it was necessary to apply a regulating device to the turbine which would cause it to take only enough load to furnish the desired amount. This regulator operates automatically and does not require the attention of the operator. During the normal heating period this unit effects tremendous savings. The engineers of the Firestone Company estimated that the savings would reach as high as two hundred dollars a day when the temperature was ten degrees above zero or lower. Better write for Bulletin SM-25 and get in touch with a Terry engineer. He may be the means of suggesting similar savings in your plant by the application of

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SEE TELEPHONE DIRECTORY FOR OFFICE ADDRESS IN YOUR CITY

THE TERRY STEAM TURBINE CO.
TERRY SQUARE
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Drive end of A-F *coal handling equipment, Greenpoint Hospital, New York*

POWER CAN WAIT FOR NO MAN

Too much depends upon the modern power plant to take the slightest chance upon a lapse of service. Supplies of fuel must be constant and assured. Adequate provision for the removal of ashes is equally important.

A-F CONVEYORS A-F

are fundamental considerations in power plant equipment.

A-F Elevating, conveying and transmission machinery is made to meet particular requirements in individual plants. With clock-like precision it accomplishes industrial feats impossible by men, in places and under conditions which men could not endure—swiftly and economically.

We invite you to consult the A-F Engineering Service Bureau. Our engineers are prepared to study your particular problems in order to devise the most efficient and economical conveying facilities for your plant. A preliminary report will place you under no obligation.

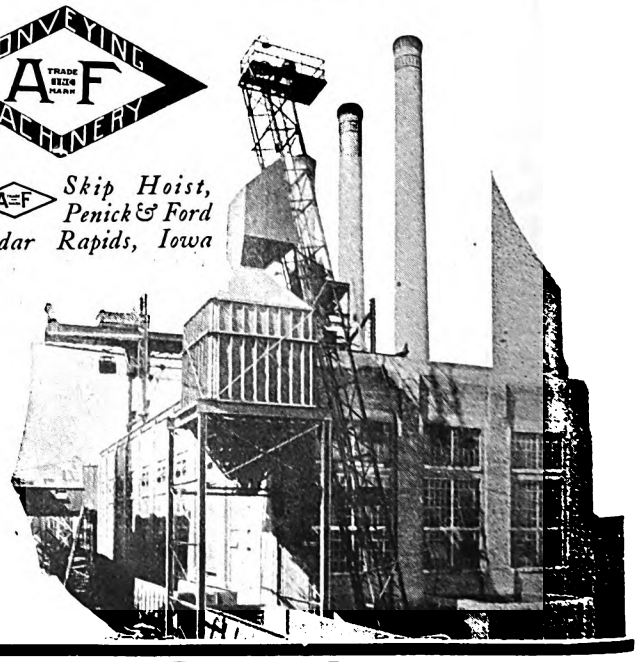
THE ALVEY-FERGUSON COMPANY

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CONVEYING MACHINERY A-F TRADE MARK

A-F *Skip Hoist, Penick & Ford Cedar Rapids, Iowa*



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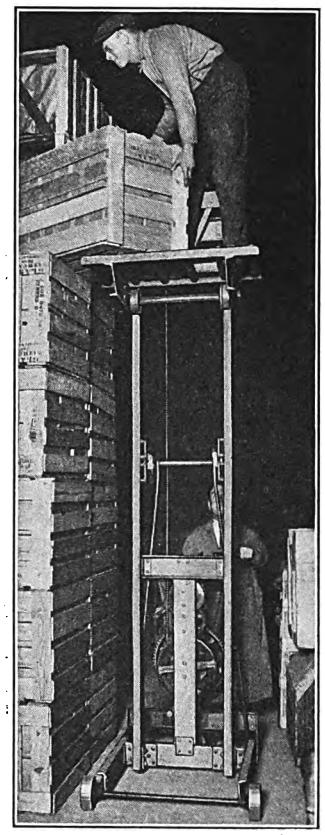
(*Continued from page 61*)

power users as a remedy for the conditions created by a large induction motor load. The motor obtains its name from the fact that it runs at the same speed, pole for pole, with the machine generating its power supply. Its speed is constant, being determined by the number of poles and the frequency of the applied voltage.

The synchronous motor will not accelerate a heavy load, and if such a load comes on suddenly while it is operating, it may be pulled "out of step" and drop its load; nor will it come back of itself if the load is removed. These disadvantages have been met by the use of clutches of one sort or another between the motor and its load but which provided a very unsatisfactory solution at best. The synchronous motor can, however, be arranged to furnish leading current to correct the lagging current produced by ordinary induction motors. Since lagging current produces a poor power factor, these machines will raise the power factor of a system and it is customary to use them to drive some machine requiring constant speed, such as a blower, because they will develop a certain amount of work while correcting the power factor.

Recently a new type of synchronous motor has been developed that can be directly connected to the driven machine without any clutch between, and which is entirely free from the poor pull-in torque characteristics of the ordinary synchronous motor. The design and operating characteristics of the new motor are sufficiently interesting to warrant description. Briefly, the frame is free to revolve, except when held by a brake of the type used on mine hoist equipments. In starting, the brake is released and current admitted to the revolving armature bringing it up to speed regardless of the load. The field, or rotor, is held stationary by the friction of the load. When the armature is up to speed, current is admitted to the field and the brake is applied gradually to the amature frame. As the latter slows down the rotor and the load comes up to speed until, with the armature locked stationary, the motor is functioning as an ordinary synchronous motor. The motor will develop a torque of from 150 to 200 per cent of normal throughout the starting period, and its acceleration is so smooth that no clutches are necessary, nor is the driven machine subject to shocks.

This motor opens up, by removing the limitations hitherto imposed on synchronous motors, a wide field of application, and a much greater opportunity for power users to take advantage of the corrective power features of the synchronous motor. Until now, the use of synchronous motors has been confined largely to constant speed, constant load machines that do not require excessive starting torque. Examples of this type of machine are compressors, centrifugal pumps and blowers, for driving motor-generator sets, and similar work. The motors have been used also in driving other machinery, especially for direct connected group drives, or line shafts, where the load de-



Lewis-Shepard Stacker
The Perfect Portable Elevator
—for piling and storing goods and materials, ceiling high. Conserves space, protects materials, saves two or more men. Made in three types:
(1) Hand Operated. (2) Combination, Hand and Electric. (3) Heavy Duty (Power) with enclosed gears,—worm drive; the most compact stacker ever made. **Best design of its kind on the market.**
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—engaged in handling and rehandling goods and materials,—usually in cumbersome, antiquated fashion. These conditions form one of the main sources of the rapidly rising tide of Labor Wastage,—a waste not only appalling but unnecessary because the adoption of the best modern handling equipment turns a large part of the present labor overhead into actual profits. Twenty-four concerns, using handling equipment made by the Lewis-Shepard Company of Boston, Mass., increased their yearly profits over $59,000. In the light of present day conditions the conversion of such useless debit into real credit becomes prophetic. For we must remember that Live facts show conclusively that Labor Costs are and will continue increasingly to be the most expensive item of production in American Industry.

"Cheap Labor" Is Costly Labor!
Unless It Works With Proper Tools

Picture the thousands on thousands who must daily push, shove, haul and lift at heavy, bulky or fragile loads. Investigation shows that 20 to 50% of the Cost of Labor is confined in many concerns to this kind of so-called "Cheap Labor." Picture the tremendous overhead rolled up by this army of unskilled handlers. Roughly compute the enormous waste! Two to four out of every five could be released for other service by the simple and inexpensive adoption of Lewis-Shepard Handling Equipment, the only logical solution of this part of the "High Cost of Labor" Problem.

Lewis-Shepard Handling Equipment
Saves Man Power and Money
by the simple but effective method of giving labor the most efficient tools to work with,—thus eliminating useless effort and slack schedules.

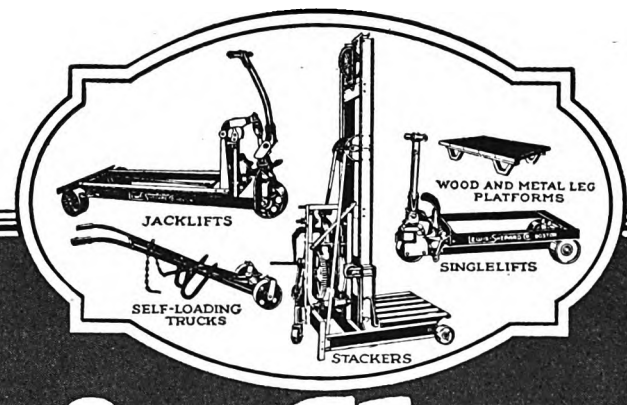
Jacklift Trucks, 2,500 to 8,000 lbs. Singlelift Trucks for Lighter Loads. Wood and Metal Leg Platforms. Self-Loading Barrel and Case Trucks. The Lewis-Shepard Stackers.

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We Guarantee Results from Our Equipment Before You Pay

50% New Business from Old Customers proves that NEW Opportunities for Saving follow the installation of Lewis-Shepard Handling Equipment. Not expensive. Over 4000 customers in past eight years.
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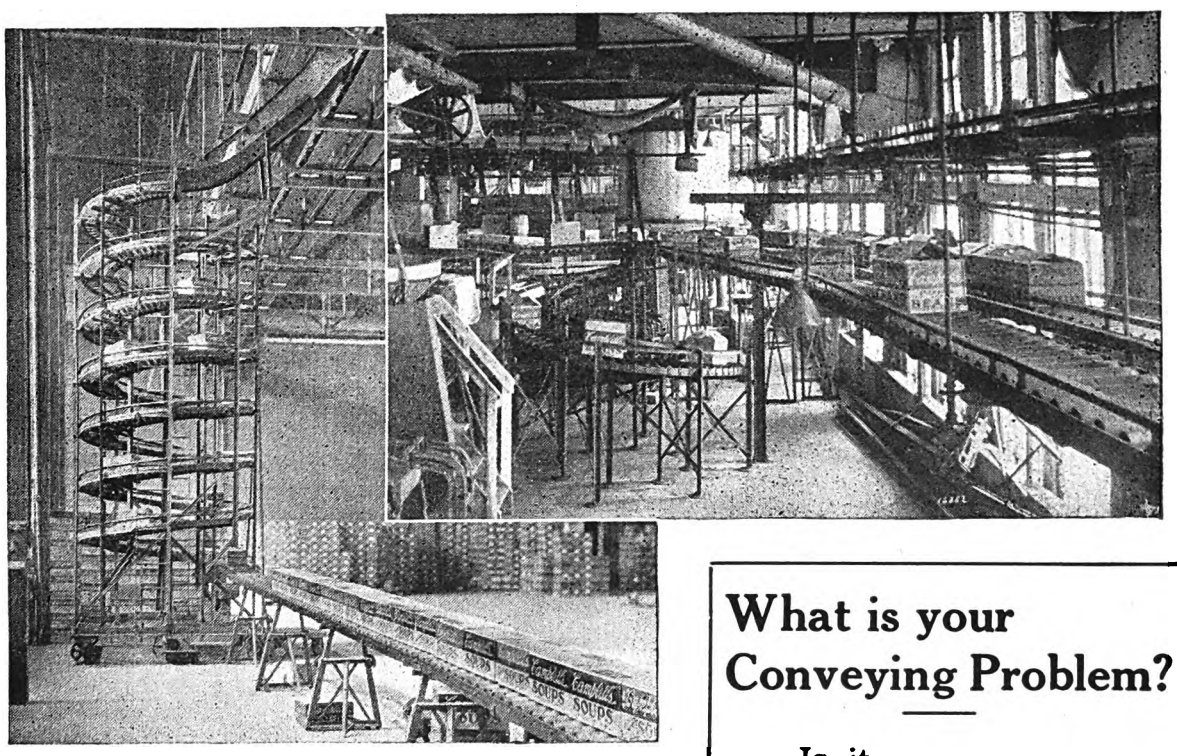
Lewis-Shepard
BOSTON

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mands can be so arranged that excessive starting torque is not required, and peaks that are liable to pull the motor out of step are not encountered. The new motor is not only applicable for this sort of work, but for other cases, where slow speed machinery requiring a high starting torque is to be driven. An example of the latter to which the new motor has been applied is the ball and tube mill used in cement manufacture. It is not too much to predict that the new synchronous motor will in time replace the induction motor in many more cases where the former type of synchronous motor was barred by its limitations.

The series or commutator rotor is analogous to the direct current series motor and its greatest field so far seems to be for single phase work, probably because the slipring, or wound rotor induction motor is only built for polyphase circuits. It is mostly used to drive fans, where the load at the various speeds is practically constant. Speed reduction is obtained by the use of resistance in the circuit.

Let Mechanical Handling Take the Place of Immigration Loss.



What is your Conveying Problem?

Is it—

Boxes,
Crates,
Cartons,
Cans,
Trays,
Tote Boxes,
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Shingles,
Pig Iron,
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excepting bulk materials. We hook gravity and power together into complete package conveying systems, linking up all the various departments of a factory to conform to modern progressive assembly practices. Or, we will provide independent conveying units for shipping, packing or any other department.

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Is the Field of the Gasoline Tractor Limited

(*Continued from page 17*)

has a gasoline tractor that can perform in a more limited space than some of the standard electric tractors, and at the same time his machine has a greater towing capacity.

Some of the uses of gasoline tractors are as follows: Merchants or dealers use them for hauling lumber, coal, brick and other materials, both in the yard and in deliveries. Industrial plants and manufacturers use them for transporting loaded trailers about the yard and from process to process in the plant, also for hauling dump wagons and trailers loaded with refuse, to the dumps. Cities, villages and counties use them in building roads, hauling garbage wagons, for cleaning streets and removal of snow. Contractors have found them efficient for excavating, hauling equipment and construction materials, operating stationary machinery and pulling big trucks out of excavations. On the golf course or athletic field, gasoline tractors are used for pulling the lawn mower, roller or other equipment necessary to keep the grounds.

What other class of equipment has such a large range of usefulness and can be operated in such out of the way places as the wilds of South America and Africa, and at the same time be so built that it can operate within the average industrial plant? Flexibility is another point to be considered in favor of this equipment. It operates without tracks or with them, it can be used on one operation today and another tomorrow. Under its own power it can transport itself from one location to another and need not worry about fuel, as gasoline can now be obtained in nearly every locality.

It might safely be said that it is up to the gasoline tractor manufacturers to educate the various industries as to how and where to use this equipment. The average engineer is not familiar with the new developments and consequently he overlooks the opportunities of saving money by installing this type of equipment.

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THE SEAT OF
Production

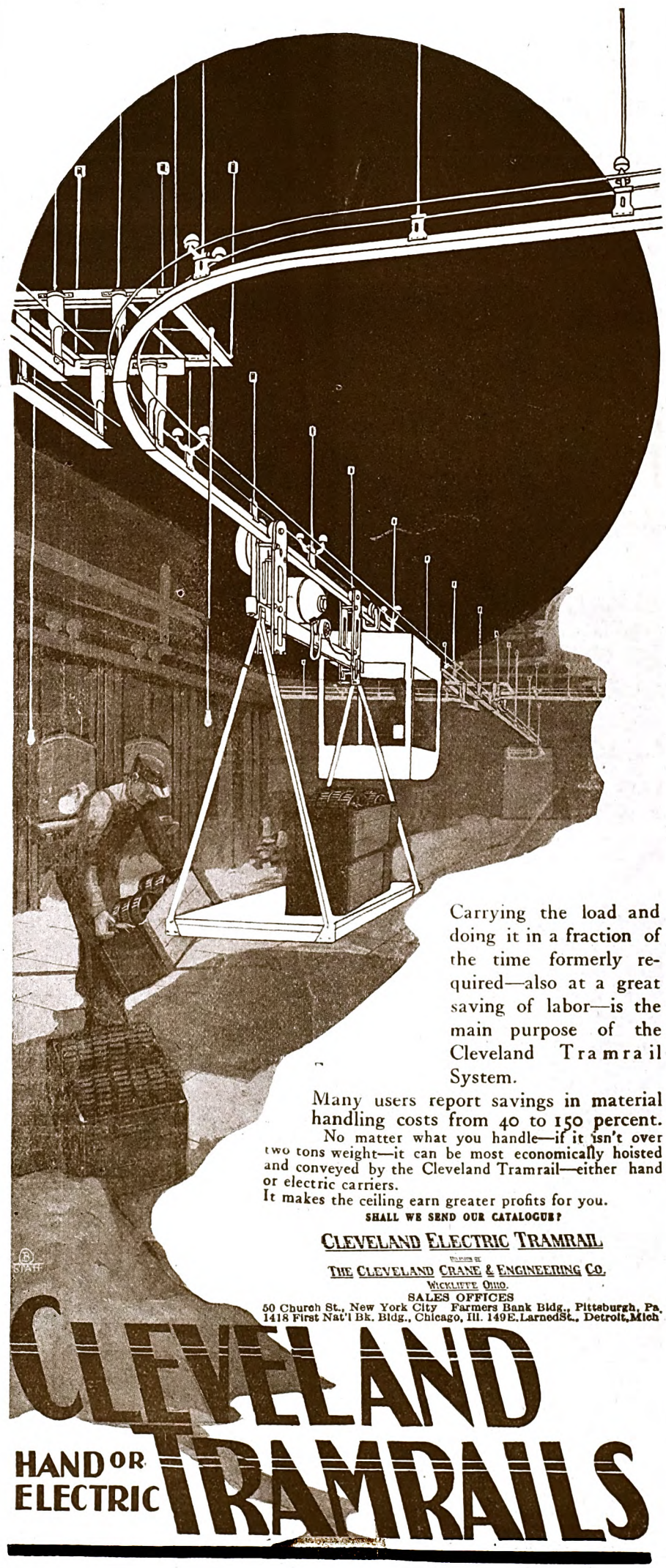


No. FS-22, Patented. Adjustable Legs and Back-Rest

Of course any stool may serve as a seat, but larger institutions prefer to capitalize seating. They buy "Royal-Chicago" Products for the returns in increased efficiency and loyalty.

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"Royal-Chicago" PRODUCTS
THE CORRECT INDUSTRIAL SEATING



Carrying the load and doing it in a fraction of the time formerly required—also at a great saving of labor—is the main purpose of the Cleveland Tramrail System.

Many users report savings in material handling costs from 40 to 150 percent.

No matter what you handle—if it isn't over two tons weight—it can be most economically hoisted and conveyed by the Cleveland Tramrail—either hand or electric carriers.

It makes the ceiling earn greater profits for you.

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CLEVELAND
HAND OR ELECTRIC TRAMRAILS

Getting Manpower to Jibe with Horsepower

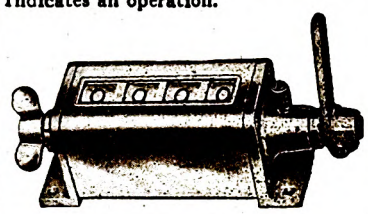
On the *mechanical* end of your machine, a certain amount of horsepower will make things move to your satisfaction.

In the case of the machine *OPERATOR*, it's the power of *interest* and *concentration* that moves to action and gets output.

When the eye of the operator is on his production-record, his *mind* is on running up that record! —with a result that registers most gratifyingly on your

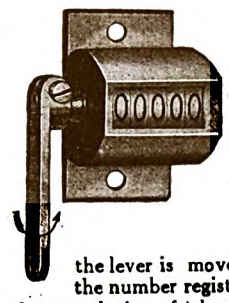
Veeder
COUNTER

The Set-Back Rotary Ratchet Counter below is for machines such as presses and metal-stamping machines, where a *reciprocating* movement indicates an operation.



Registers one for each throw of the lever, and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, $11.50—subject to discount. (*Cut less than ½ size.*) Set-Back *Revolution* Counter of similar model, $10.00 (list).

This small Rotary Ratchet Counter (No. 6) counts reciprocating movements of the lever, as required for recording the output of innumerable small machines. When the lever is moved through an angle of 40 to 60 degrees, the counter registers one. The further the lever is moved, the higher the number registered. A complete revolution of the lever registers ten. This counter can be adapted to no end of counting purposes, by regulating the throw of the lever. Price $2.00. (*Cut nearly full size.*) Small *Revolution* Counter also $2.00.



FREE—This new 80-page booklet shows everything you could ask in a counter Ask for It.



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HUNT

ELECTRIC MOTOR CARS

Are Cutting Handling Costs in these Fertilizer Plants

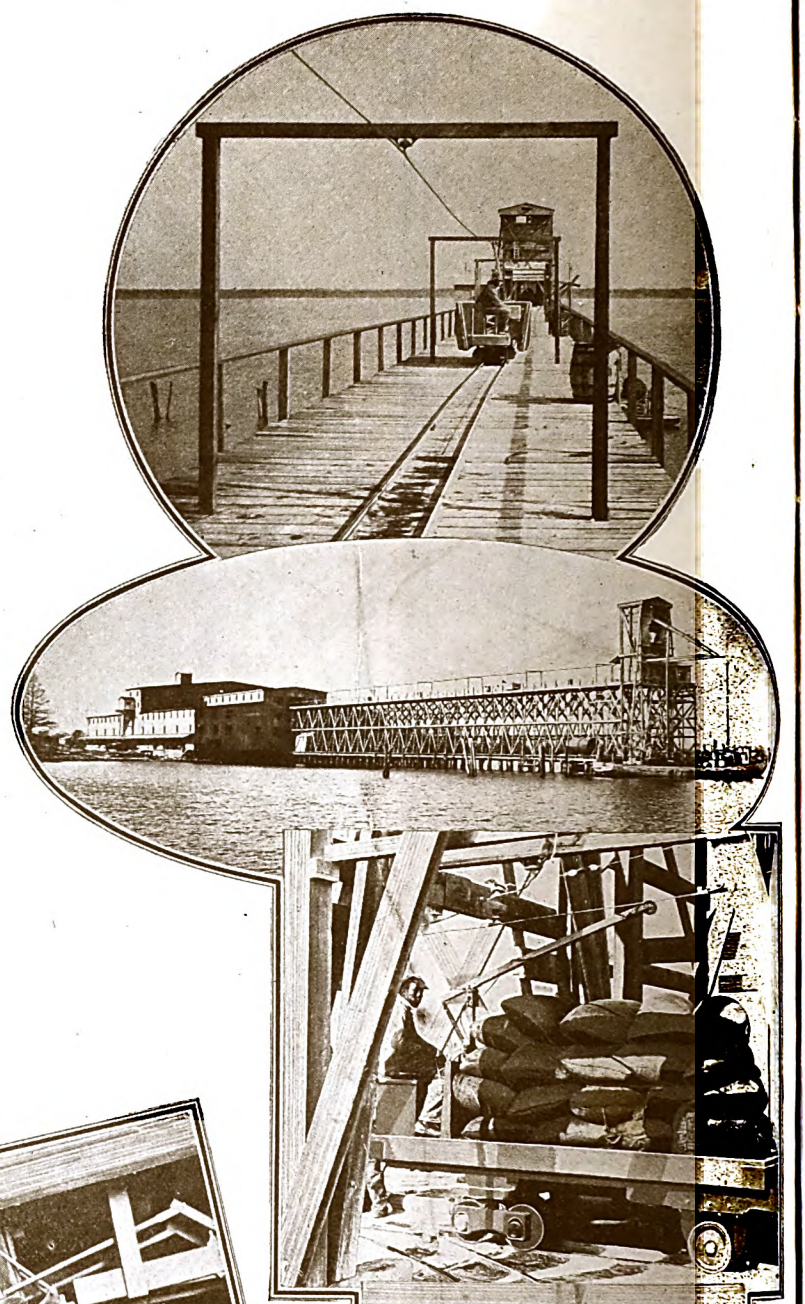
Bulk, bagged and cased material is rapidly transported from pier-head to storage bins, — and can be automatically discharged at any designated point at will,— with the greatest rapidity at a substantial reduction in manual labor and a satisfactory saving in operating and maintenance costs with this —

RAPID-RUGGED-RELIABLE HUNT COST-CUTTING EQUIPMENT

This equipment can also be applied to any industry having similar problems.

Manufactured in single and double Truck drives, for Third rail and single and double overhead Trolley systems. Will operate on 12' 0" radius curves.

Write for literature dealing specifically with this class of equipment.





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What Building Means to Business

(*Continued from page 21*)

functions of production, transportation and distribution. The products which persons and business use may be divided roughly into three classes: first, housing for families, for manufacturing operations, for merchandising, and other purposes; second, the equipment to go into this housing; and third, the supplies required for current use and consumption. Buildings come in the first of these groups, and constitute the more bulky and permanent type of products, the average dwelling, for example, representing a value of from three thousand to four thousand dollars. Machinery, power plant equipment, store fixtures, office furniture, house furnishings, fall in the second class and have a considerable length of life, shorter however, on the whole than that of most buildings; while oil and waste, water, raw materials for factory use, ink and stationery for stores and offices, and food, clothing, coal, gas and other items for family consumption, come in the third class, and are consumed rather rapidly.

Keeping in mind this rough division of the field, let us consider some of the principal facts regarding building as carried on under normal conditions, the volume during the year just past, and the prospects for 1923, together with the relation of this volume of building to manufacture and trade.

The normal volume of building in the United States for nine years prior to the great war, ranged from about two and a half to three and a half billion dollars a year, according to the best figures obtainable. But not all of this was new construction. About one-seventh consisted of additions, alterations and repairs to existing structures; the other six-sevenths were new buildings, as shown by the following chart and table, the latter giving the average percentage over a series of years.

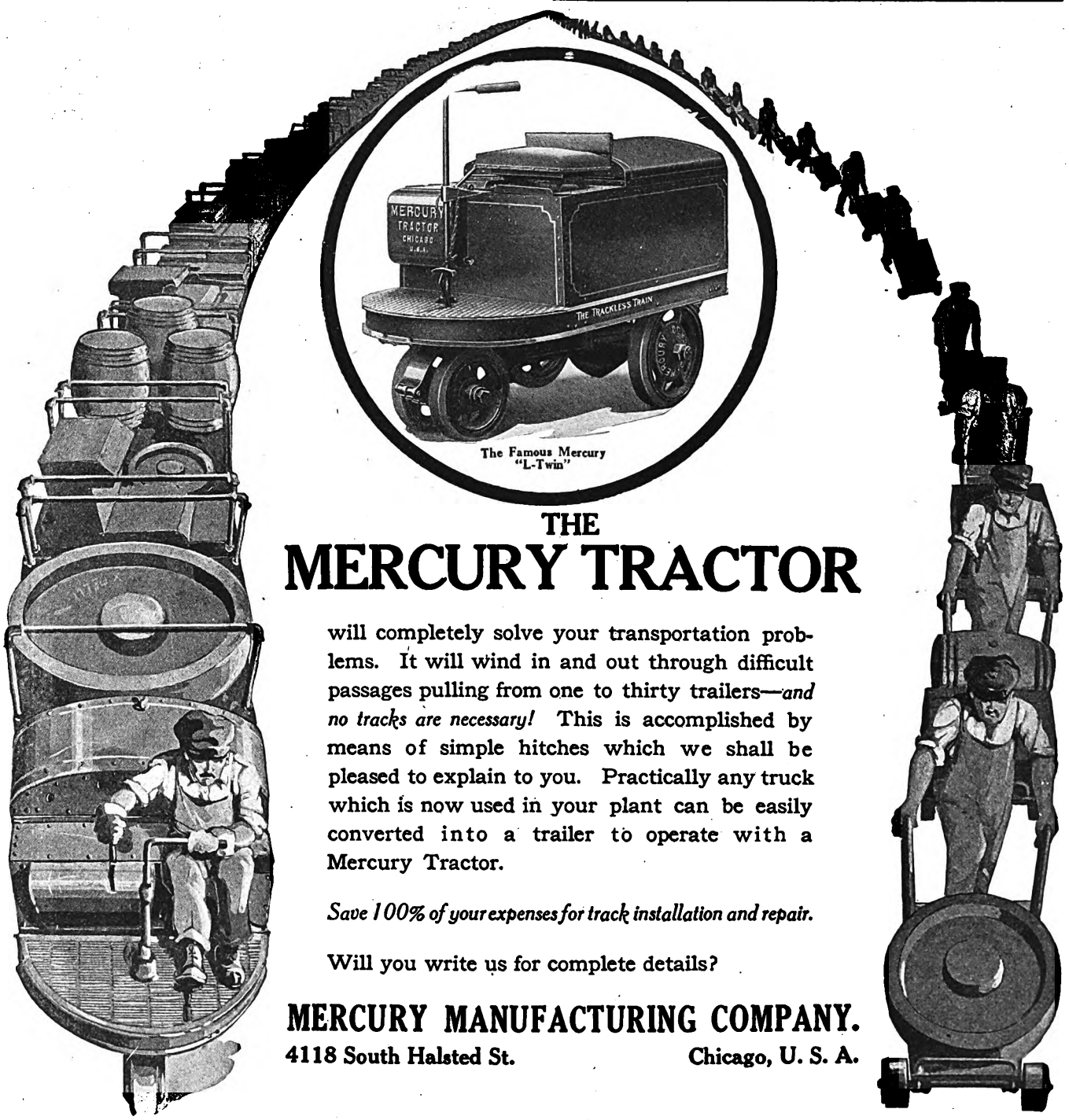
From the table (Table I), it appears that the average percentage of alterations, additions and repairs for the seven years covered, has been about fourteen percent; which swelled in years such as 1918, during the war, or 1920, the beginning of the depression, to a higher figure, and shrunk to a lower one in 1910, 1911, and 1912. So far as partial figures are available, it appears that in 1922, the proportion of new construction was high, and repairs more nearly normal or below normal.

This volume of building includes several different kinds of buildings, the main purposes for which they are used being for residence purposes (houses, and apartments), manufacturing (mills, factories, repair shops, etc.), merchandising and other business (stores, offices, etc.), and miscellaneous, which includes school buildings and other public structures, churches, theaters, etc.

The diagram (Fig. 2.) and

(*Continued on page 69*)

ONE MAN or FIFTEEN?



The Famous Mercury "L-Twin"

THE MERCURY TRACTOR

will completely solve your transportation problems. It will wind in and out through difficult passages pulling from one to thirty trailers—*and no tracks are necessary!* This is accomplished by means of simple hitches which we shall be pleased to explain to you. Practically any truck which is now used in your plant can be easily converted into a trailer to operate with a Mercury Tractor.

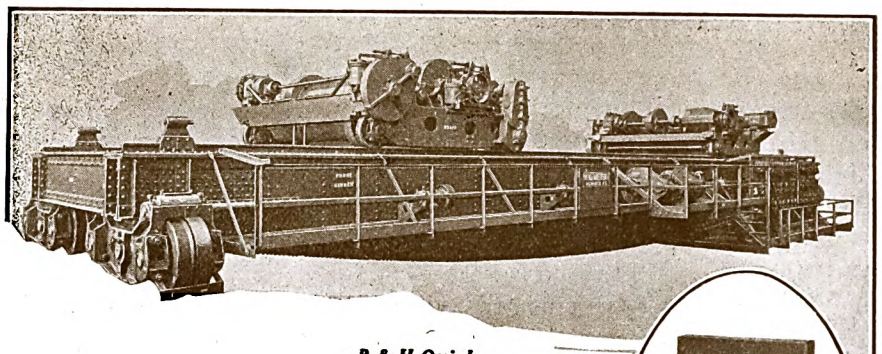
Save 100% of your expenses for track installation and repair.

Will you write us for complete details?

MERCURY MANUFACTURING COMPANY.
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THE TRACKLESS TRAIN

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P & H Quick Lowering Relay

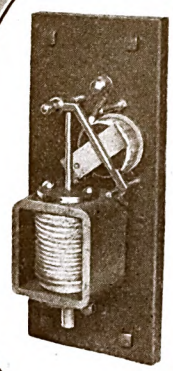
Increased Profit on Crane Investment

From the first—(nearly 40 years ago)—thorough, careful craftsmanship has been apparent in P & H equipment.

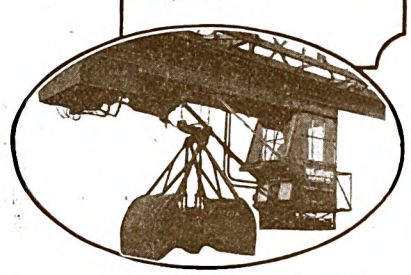
Working for all these years with the one idea of making *good* cranes, hoist and monorails, machine tools, etc., P & H craftsmen have taken advantage of every method and experience to improve the design and manufacture.

The fact that over 7,000 P & H. Traveling Cranes are in use is evidence that industrial men know through experience that P & H Cranes reduce material handling costs—last longer—cost practically nothing in maintenance, —and pay a big return on investment.

There is a precision, an effortless ease and dependability about P & H Cranes that place them quite apart, regardless of whether the unit is of small 3 or 5-ton capacity, or 200-ton.



For the Steel Mill, Foundry, Industrial Plant, Railroad Shop and Yard, Power House, Machine Shop, Automobile Plant, Chemical Plant, Lumber Industry, Rubber Mill, Cement Plant, Paper Mill and wherever overhead handling of materials is required.



P & H Grab Bucket Hoist

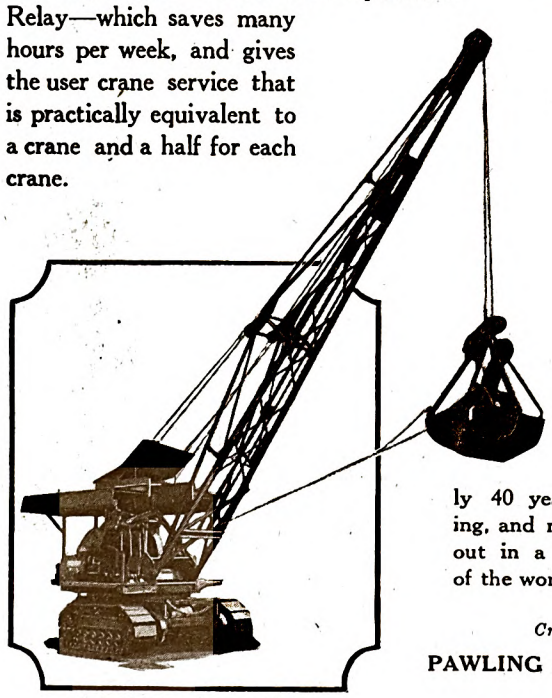
P & H Quick-Lowering Relays Eliminate Wasted Time.

Apart from their inherent qualities, P & H Cranes have the distinctive quick-lowering feature—the result of a patented Relay—which saves many hours per week, and gives the user crane service that is practically equivalent to a crane and a half for each crane.

Front Lever Control

P & H has also developed the safety cage with front lever control giving the operator unobstructed view increasing the speed of handling. And all switch and control parts are entirely enclosed in a cabinet so that there is no chance of coming into contact with live parts.

These P & H features are created and made possible because of the thorough craftsmanship based on nearly 40 years' experience,—sound designing, and manufacturing principles carried out in a plant complete in every sense of the word.



P & H Corduroy Crane

An important labor-saving portable auxiliary for yard work. Travels anywhere on its Corduroy Traction. Operated by ONE man.

Crane and Hoist Division

PAWLING & HARNISCHFEGER CO.

Established in 1884.

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New York	*Chicago*	*St. Louis*
Pittsburgh	*Philadelphia*	*Birmingham*
Phoenix	*Denver*	*New Orleans*
Los Angeles	*San Francisco*	*Portland*
Salt Lake City	*Seattle*	*Atlanta*

P&H CRANES and HOISTS

the table below show the proportions of various kinds of buildings erected. These include both new buildings and alterations and the Dodge figures include construction work other than building:

From this table and chart the importance of residential construction is evident. It must be remembered, however, that the large amount of factory building which took place in 1915, 1916 and 1917, to meet war demands, was followed by an unusually small amount of industrial construction, and that the percentage of dwellings during the four years covered may be higher than normal.

An increase in population of fourteen or fifteen million in ten years—to be exact, 13,738,-354 between 1910 and 1920—means, at the rate of five persons to a dwelling (including apartments), some 275,000 to 300,000 new houses or apartments each year. There must be also new stores to serve these new houses, and new factories to make the goods sold in the stores, so that the volume of annual building is roughly in proportion to the increase in population.

The money spent for building is paid out partly for materials, partly for labor and partly for contractor's expenses and profits. The proportion of materials to labor appears to be between three to two, and three to three. According to a study made by the National Federation of Construction Industries in November, 1921, covering the costs of construction of seven different types of buildings, in the Philadelphia district, the proportions are about 44 percent for materials, approximately the same for labor, and about 12 percent for contractor's expenses and profits. For the purposes of this article, these percentages of the costs of construction may be taken as roughly representative of other sections of the country. Assuming that these same ratios held in 1922, the money spent for building, goes mainly to those employed in the building trades, and to manufacturers of construction materials, as indicated on the chart, Fig. 3.

It is obvious that an increase in building of 50 percent over the preceding year, as hap-

Uhl Steel PosturChairs Increased Production 10%

for some workers in a Boston publisher's bindery. Fatigue is decreased by the perfect adjustment possible with this chair to the individual seating condition.



There is only one right way to sit. The seated skeleton tells the story.

The PosturChair is designed to fit the seated body. It encourages good posture and makes it the comfortable position. It has been designed by experts in seating. It is approved by a nationally known health organization—the American Posture League, and each chair bears its label.

It is a piece of production machinery and as such is being adopted by large employers of labor everywhere.



This chair supports the body where support is needed and eliminates preventable fatigue.

Special Features: Made of cold rolled steel except seat and back support which are of wood. 10 heights, each with 3" height adjustment. Seat tilts forward or backward. Back support, swivel and adjustable in height. Durably constructed, neatly finished.



There is a style and height to meet any working condition.

TRY ONE AT OUR RISK

If you are seeking more production and greater health protection for your workers, write us for a sample to try under your own conditions. It's free for two weeks use. Mention height needed. Descriptive pamphlets available.

The Toledo Metal Furniture Co.
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Manufacturers of steel equipment for factories, stores, offices and schools.

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pened in 1922, means a large increase both in wages and in demand for lumber, cement, brick, structural steel, lime, paint, glass, roofing, and all the other materials required in the erection of structures for business uses, for dwelling, and other purposes.

The first and most immediate effect of this season of active building has been to relieve the worst of the existing shortage of homes and business structures; the second has been to provide steady work for a million and a half or a million and three-quarters wage-earners, whose wages spent in stores and elsewhere have provided comforts and necessities for their families.

This outlay has made business for the merchant who supplies the goods and for the manufacturer from whom the merchant orders. The effect of the spending of an extra quarter or half billion dollars of wages earned this past year, because carpenters and masons and steel erectors and hod-carriers were in demand, has been to expand the volume of business by that amount and keep money in active circulation.

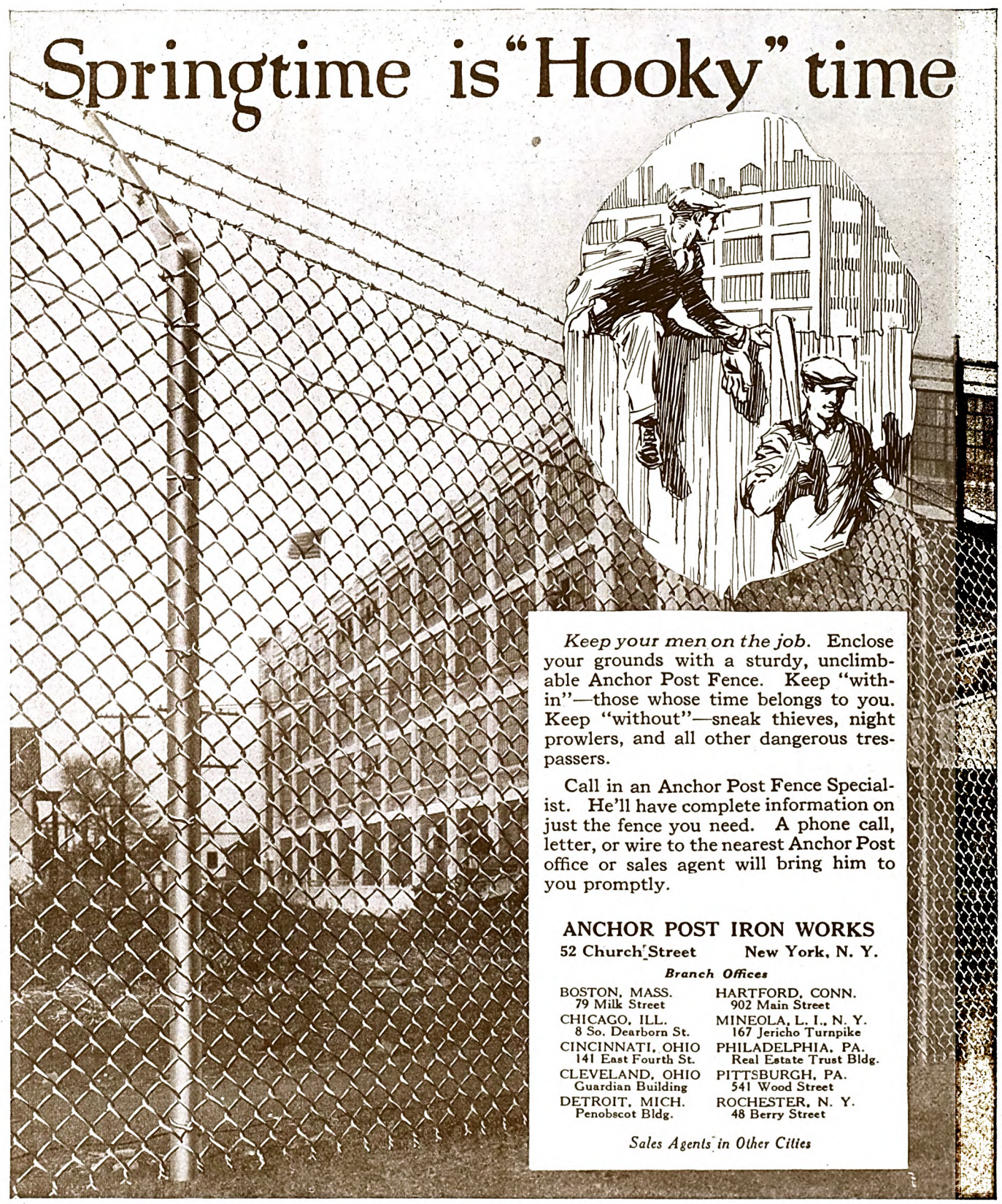
The indirect effects of active building and the continuous employment resulting are hard to measure. For wages are spent and spendable not only for goods, but for services as well, and the money of the building workers has gone to pay for needed medical care and dental work, for new plumbing, for electrical fixtures, for insurance, for other wants, and this means business for the dentist, the electrician, and professional and service men of all kinds.

Another direct effect of increased building is the enlarged demand for building materials—lumber, building stone, cement, structural steel, brick, tile, lime, lath, shingles, sash and doors, window glass paint, pipe and sanitary equipment. These basic commodities, which enter so vastly into construction, represent a volume of production of perhaps three billion dollars and give employment to three-quarters of a million workers. Here again, building means business for manufacturers and busy wage earners.

The workmen employed by sawmills and cement plants, brick yards and glass factories, steel mills, paint works and all the other manufacturers of materials, having more wages to spend, spend more, in stores and retail shops, for personal and home betterments; and the money circulates actively throughout the community. It is clear that there is a close connection between brisk building, and good business for retail merchants and for the manufacturers from whom they buy their goods.

The third direct effect of increased building is in the field of the equipment of buildings. At this point the figures begin to have significance for another group of manufacturers—those who supply fittings and furnishings for all the various kinds of buildings, which cover a wide range.

In general, these products fall into two classes, and constitute two fairly distinct markets—one, the equipment required for business and miscel-





FIRM—BECAUSE THEY ARE ANCHORED

Anchor Post Fences

PERMANENT—BECAUSE THEY ARE GALVANIZED

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MATERIAL



ELECTRIC TRACTORS

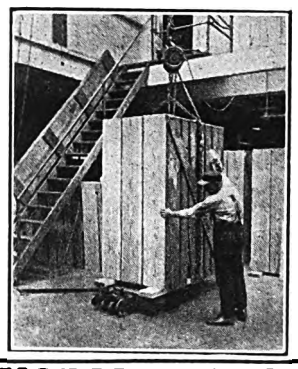
Transport Tons

where hand trucks move pounds. They reduce expense in all your departments.

Request Catalog 1208.

The Elwell-Parker Electric Company

Cleveland, Ohio



MOTORBLOC

The Motor Driven Chain Hoist

The MOTORBLOC is hung up like any chain hoist.

He is pulling 1 Pound to Lift 2200 Pounds.

Light—Portable—Steel-Strong

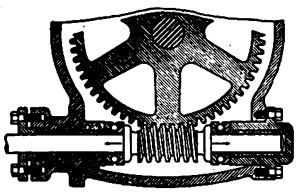
"Hook Up, Plug In, Let's Go." Write for full details



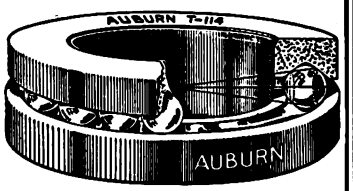
MOTORBLOC CORPORATION

Summerdale PHILADELPHIA

WORM DRIVES OPERATE MORE SMOOTHLY WITH **AUBURN THRUSTS**







Reduce back lash, increase the life of both Worm and Gear, and get smoother operation by using AUBURN BALL THRUST BEARINGS. Tell us your problem and get the Auburn Answer. Ask for Catalogue.

STEEL BRASS AND BRONZE BALLS

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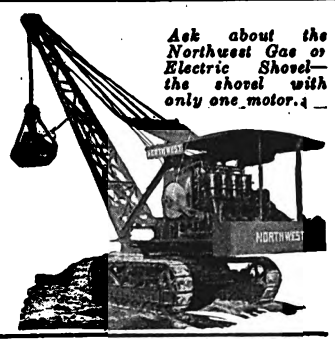
20 INDUSTRIAL STREET ROCHESTER, N. Y., U. S. A.

Unrivalled Utility a Result of Unmatched Mobility—

You may buy the Northwest with the idea of using it for routine handling work—but you'll be surprised at the number of odd jobs it will do in spare time. Handles coal, ash, stone, sand, gravel with 1 yd. clamshell bucket on 40 foot boom; timbers, logs, stone slabs, pipe, building forms with grappling hooks; steel and iron scrap with powerful electric magnet; acts as dragline or as pile driver.

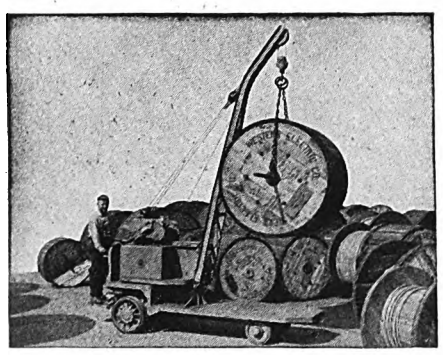
Northwest crawler base with truck-like steering device is controlled by one man; unequalled mobility; will mount pile and double-deck. Ask for specifications.

Northwest Engineering Co., 1231 Steger Bldg., Chicago, Ill.



Ask about the Northwest Gas or Electric Shovel—the shovel with only one motor.

NORTHWEST CRAWLER CRANE



Easiest Way to Handle 3,000 Pound Pieces

is on Electric Industrial Trucks equipped with REVOLVING CRANES.

Bulletin 51 tells how.

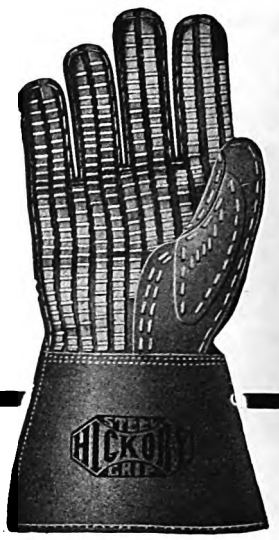
The Elwell-Parker Electric Company

Cleveland Ohio

HANDLING

laneous uses, the other, for dwellings. For new factories and additions to existing factories there must be provided a long list of items ranging all the way from ventilating systems or special flooring to simple objects such as time slips or lead pencils. In the list there are electric cranes and hoists, steam power installations, pumps of various kinds, motors, pulleys, industrial trucks, tanks, valves, fans and blowers, fencing, gauges and other instruments, time clocks, carriers and conveyors, scales, stencils, steel lockers, control boards. In office buildings there must be elevators, revolving doors, heating apparatus, electric lighting, rubber mats. For stores must be provided shelving, counters, lighting fixtures, special display racks, scales or measuring devices, cash registers, cash carriers, and other items. For schools and churches, theaters and public buildings must be made special furniture, lighting fixtures, and products harder to classify under the common heads. Dwellings require electric wiring and fixtures, furnaces, stoves, kitchen utensils, dishes and glassware, dining tables, lamps, easy chairs, mirrors, beds, bureaus, and the thousand and one things with which the new house must be supplied. The makers of furniture and chairs and cutlery, of kitchen ranges and coal stoves and wood heaters, of boilers and stovepipe, of wall paper and shades and curtains and carpets and rugs, —all these have to supply needs created by new homes. And a considerable part of the present unusual demand comes from those who, having sold their former homes, have been living for months in cramped and narrow quarters, and are just now getting back to the size and kind of home that they had before the war.

Closely connected with equipment items and sometimes difficult to separate sharply from them is the long list of supplies required not only for personal consumption in homes but also for everyday use in business. Offices require filing cabinets, typewriters, adding and calculating machines, paste, paper, ink, clips, pins, blotters, pens, carbon paper. Stores use brooms, window cleaning supplies, light



No. 644 Gauntlet Glove, reinforced with flexible steel ribbons clinched over strips of tough leather. Extra leather patch on the thumb.
$16.00 per dozen pairs.

A Better Day's Work with

STEEL-GRIP GLOVES

The Added protection of STEEL-GRIPS aid the men in giving a better day's work.

Three thicknesses of wearing surfaces and a comfortable lining—steel ribbon re-inforcement clinched over tough strips of leather—strong steel thread stitching—all tend to give the workers confidence that their hands will be safe from bruises and cuts. And there's no danger of seams ripping, burning or tearing out.

STEEL-GRIPS save time by eliminating frequent trips to the store-room, because they are built stronger and wear longer.

There's a style for every condition. Try a dozen pairs—you'll see the difference.

Send in your order to-day.

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INDUSTRIAL GLOVES CORP.

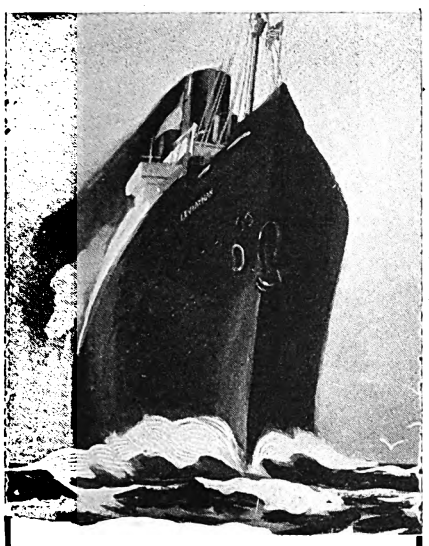
2647 Maplewood Ave., Chicago.



No. 605 Short Glove steel ribbon reinforcement and extra wearing patch in palm. $14.00 per dozen pairs.

STEEL GRIP
MADE IN CHICAGO

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the pride of the U. S. Merchant Marine will represent the best efforts of American science and engineering. Deep within the heart of this magnificent liner, the steady pulse and throb of motive equipment denotes power,—power generated without loss or waste,—power conserved and utilized to the utmost.

SIL-O-CEL

PREVENTS HEAT PENETRATION

TRADE MARK REGISTERED U.S. PATENT OFFICE

A CELITE PRODUCT

guards the Leviathan boilers from heat and power waste. This high temperature insulation was selected for such exacting service because it possesses the lowest heat conductivity of any known material. Placed between firebrick and outer shell, it saves fuel, increases capacity, maintains uniform temperature and protects the outer shell. Firebrick is laid up with Fraxite (High Temperature Cement), another Celite Product.

Sil-O-Cel Insulation is furnished in four convenient forms,—brick, block, powder and cement. It is low in cost, easily applied,—a permanent insulation.

Write for details on insulating your equipment. Specific data given in Bulletin W-6C, or use the coupon.

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CELITE PRODUCTS COMPANY

Gentlemen: Send Bulletin W-6C and explain in detail the advantages of SIL-O-CEL Insulation, how it saves fuel, increases capacity and maintains even temperatures. I am particularly interested in the insulation of

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Name Type of Equipment

Name.....

Firm Name.....

Address.....

bulbs, wrapping paper, twine, circulars and bill-heads. Factories must have an even longer list of supplies. Dwellings require foodstuffs of a wide variety, clothing, coal, fuel, books, and other items of daily consumption.

Figure 4 shows some of the more important products used as equipment or supplies mainly in business or industrial buildings of one kind or another. Some of these products and others not shown for lack of space are used also in connection with dwellings and miscellaneous structures.

Many of the products listed on this chart are supplies for use in connection with existing structures. Others constitute the initial furnishings for new buildings or additions to old. It is not feasible to separate equipment sharply in all cases from supplies; in general, however, the market for the more permanent and durable products lies in connection with the newer buildings, the first equipment of which is likely to suffice for some time. Even in the field of current consumption items, new buildings mean added business.

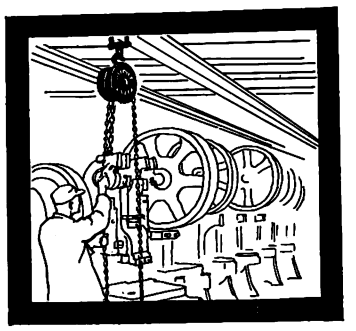
Building, therefore, is the first step in the process of making and distributing a great variety of goods. It supplies a definite location and shelter for the many activities which men carry on. Construction is necessarily followed by equipment and equipment once installed requires maintenance, and with it the whole long list of commodities currently consumed. Active building such as that of 1922, means not only additional wages for workmen, and increased demand for building materials, but also more business for manufacturers of equipment and supplies of nearly every kind.

For these reasons the prospect for 1923 is of particular interest. Will building continue to be as active during this coming year as it was during 1922?

To answer this question, it is necessary to go back to the period of the war and see just how far behind the country got in building, and to what extent the shortage has been made up already.

As previously shown, the average volume of building in the entire country annually, prior to the war (which cre-

MATERIAL



Chain Hoists for All Purposes



¼ to 30 Tons Capacity

Safe Dependable Economical

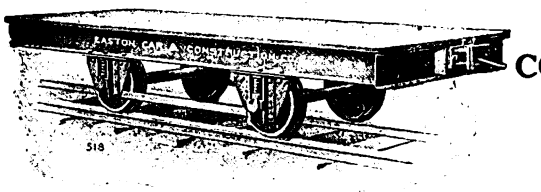
WRIGHT MANUFACTURING COMPANY

Our catalog will interest you

Lisbon, Ohio

EASTON CARS

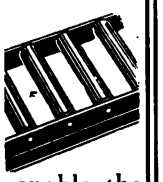
EASTON CARS



COMPLETE INDUSTRIAL RAILWAY EQUIPMENT

178-E
EASTON CAR AND CONSTRUCTION CO.
Main Office & Works: 45 Holley St., Easton, Pa.

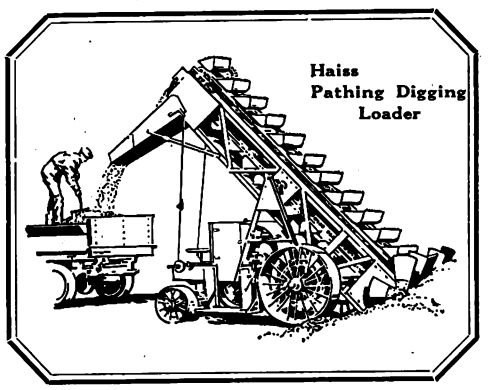
***"Handling"* is the wrong word**



when applied to Dow Conveyors. *Handling* suggests *carrying by hand* whereas the very purpose of Dow Conveyors is to dispense with costly human effort in moving parts and finished products from one place to another. Dow Conveyors (Gravity and Power) do away with porters and enable the skilled mechanic to devote *all* of his time to production instead of intermittently walking the floor. Many manufacturers are not aware of the time-labor-and money-saving ability of Dow Conveyors. The facts are yours for the asking. The Dow Co., Incorporated, Louisville, Ky.



DOW CONVEYORS



Stop Shoveling!

HAISS

Truck Loaders

do the same work—dig as well as load—ten times as fast at fractional cost.

See data in Bulletin 621

The Geo. Haiss Manufacturing Co., Inc.
146th St. & Canal Place, New York
Established 1892
Representatives throughout the world

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for the next issue of INDUSTRY ILLUSTRATED is now due.

The first closing date is the 10th of the month preceding the issue.

In order to get good service cuts and copy should be in as soon after the 1st of the month as possible. Send all advertisements to

Advertising Department
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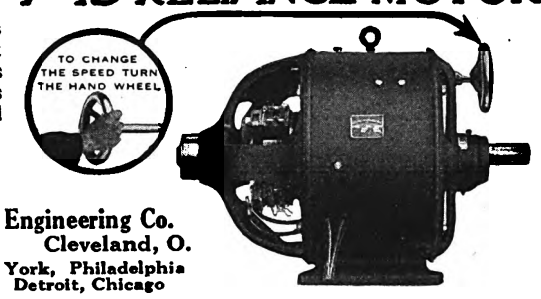
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POWER

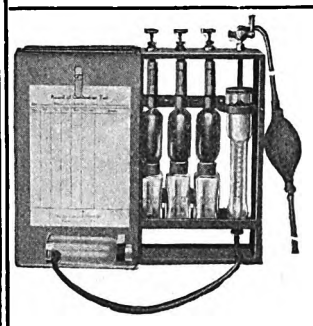
THESE motors will provide your machines with operating speeds to suit all kinds of jobs. They run at any speed over ranges up to 1 to 10. There is no power lost as speed is varied.

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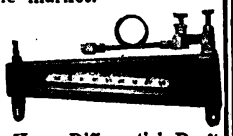
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Hays Improved Gas Analyzer. Note absence of pinch clamps, rubber connections and glass cocks.

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Hays Differential Draft Gage. Baked black enamel finish, steel case Rugged, accurate.

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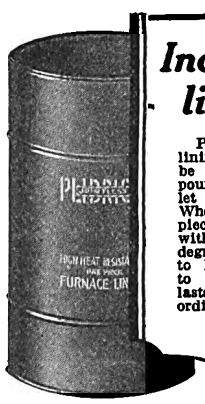


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EQUIPMENT

ated the present shortage) was between two and a half and three billion dollars a year. In forty cities for which we have continuous figures since 1900, the average aggregate value of buildings was postponed. This meant that people were crowded into narrower quarters; merchandising had to be done with existing facilities, and existing offices had to

TABLE 1.

Proportion which additions, alterations and repairs constitute of total building operations in over 100 leading cities of the United States, 1910-1921.[a]

Year	No. of cities reporting	No. of building permits	Value of permits (millions of dollars	Percent. which new construction is of total	Percent. alterations and repairs are of total
1910	127	282,661	$ 854	90	10[b]
1911	108	215,248	731	88	12
1912	105	198,272	660	88.4	11.6[c]
1913	108	203,746	608	85	13[d]
1914	113	205,728	545	84.6	12.4[e]
1915	123	251,765	655	85.8	11.2[f]
1916	129	308,498	853	83	13[g]
1917	129	240,936	633	82	14[g]
1918	132	200,786	373	72	23[h]
1919	141	365,972	1,303	85	15
1920	131	405,941	1,343	80	20[c]
Average			1600	85.9	14.1

[a] U. S. Geol. Survey, 1910-1919: U. S. Bureau of Labor Statistics, 1920.
[b] 9.81 plus part of undistributed 0.41 per cent.
[c] Approximate.
[d] Undistributed, about 2 per cent.
[e] Undistributed, about 4 per cent.
[f] Undistributed, about 5 per cent.
[g] Undistributed, about 3 per cent.

Table 2, Percent. of Value of Total—Represented by Different Classes of Buildings.

	(per cent) Building permits U. S. Bureau of Laor Statistics.	Contracts awarded (F. W. Dodge Co.)			
	1920	*1919*	*1920*	*1921*	*1922*
Residential	40	33	22.3	37.2	40
Industrial	16	19.9	23.0	7.3	10
Stores, Offices and other commercial	24	15.7	17.3	14.3	15
Other buildings	20	31.4	37.4	41.2	35

Table 3. Volume of Building in Forty Cities, in VTVC *Prices.*

Year	*Volume of Building in 40 cities (Millions of Dollars)*	*Index number of Building costs (1913=100%)*	*Volume of Building in 40 cities in prices of 1913 (Millions of Dollars)*
1912	680		
1913	606	100	606
1914	553	96	576
1915	601	98	613
1916	734	114	644
1917	461	139	331
1918	272	153	177
1919	846	167	506
1920	914	224	408
1921	1143	179	638
1922	1715	177	970

the buildings for which permits were granted annually was about $600,000,000. The war however, took the men engaged in the building trades away to work in constructing training camps, building ships, and to service overseas. Also, materials, for peace time structures were hard to get. The construction that took place during 1917 and 1918 was of government cantonments, munition works, piers and ships, and war-time factories which had not previously expanded. The building of dwellings, stores, schools, and office handle increased business. The steadily expanding number of school children had to study and recite in existing class rooms, halls and laboratories. When the war was definitely over, therefore, people set about remedying the situation of cramped conditions, and the active building of 1922, and what is to come in 1923, are an effort to provide the needed housing, stores, schools and office structures.

The effect of the war was not only to greatly reduce building, but also to increase the costs of building, so that

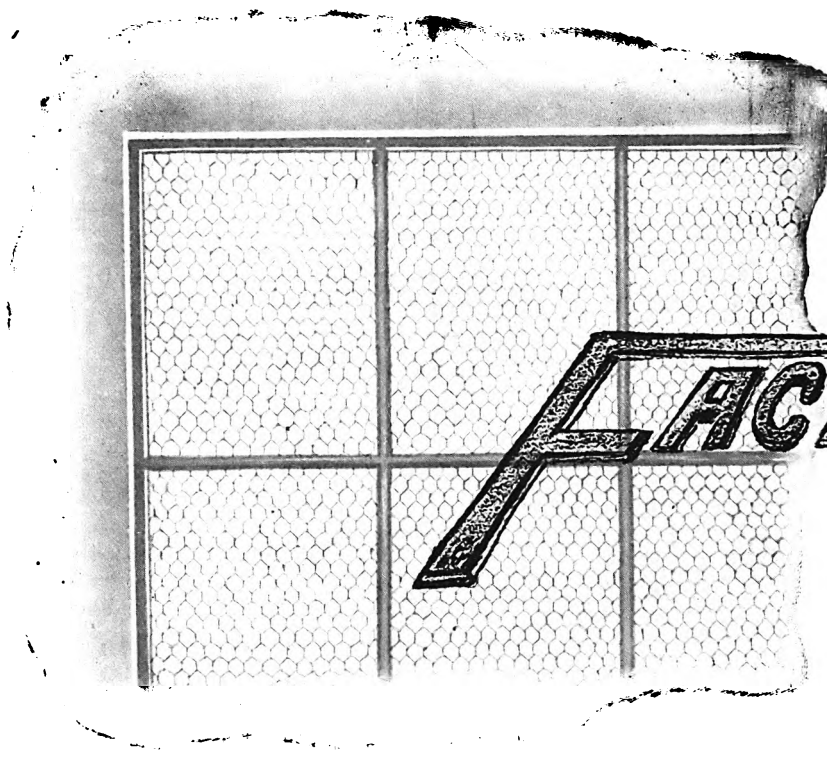
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at the peak of prices in 1920, the prices of building materials as a whole were three times what they were in 1913, while building wages rose to twice their former level. By 1922, building costs, made up of material prices and wages, had fallen to about one hundred and seventy-five, or one and three-fourths times those of 1913. To compare the real volume of building—as measured by floor space in 1922, for example—with that in 1913 or 1914, it is necessary not merely to look at the total money cost, but to reduce this money cost to terms of physical volume of building by dividing the money cost by one and three-fourths, the number of dollars which in 1922 were equal in purchasing power to one dollar in 1913. When this is done the 1922 volume of building which at first sight appears as of unheard of proportions, proves to be a much more moderate figure than was supposed. A glance at the figures of building in forty cities for each year since 1912, with the corresponding value in 1913 prices since that date, shows at once what the 1922 figures really mean in terms of actual physical building, the index number of costs being merely a means of showing that it takes one and seventy-seven one-hundredths dollars now to buy what one dollar bought in 1913.

From this table it is clear that the normal building in these forty cities from 1913 to 1916 in terms of 1913 prices was about 600 million dollars a year, and that the building during the four years 1917, 1918, 1919 and 1920 amounted altogether to about 1,400 million dollars (in 1913 prices) in place of a normal 2400 million dollars (4 years at 600 million a year) or a shortage of about a billion dollars in these forty cities. This is equivalent to one and two-thirds years shortage—that is, it is the same as if we had done no building at all for one and two-thirds years, but were now starting to catch up. The year 1921 appears to have had about a normal amount of building, but in 1922 the building amounted to one and a half times that of 1921. We have made up during 1922, in other words, a half year of the shortage, but there remains yet something over a solid year of building before we shall have made it up completely. This is a remarkable achievement, when it is remembered that this is in addition to the normal volume of building which is required every year.

That is why it is certain that 1923 will be another year of exceptional building, unless prevented by unduly high costs of materials and labor, both of which are at present trending upward. The chart (Fig. 5) shows the upward movement of prices and wages since the low points of 1921 and early 1922.

With the cost of living at 166 and building at 180 with a tendency to go higher, the question is how far building can progress on the strength of the present shortage before it encounters something like another buyer's strike. As long as building proceeds, however, it will increase the demand for other goods, as shown, and will help to stimulate the business of the entire community.



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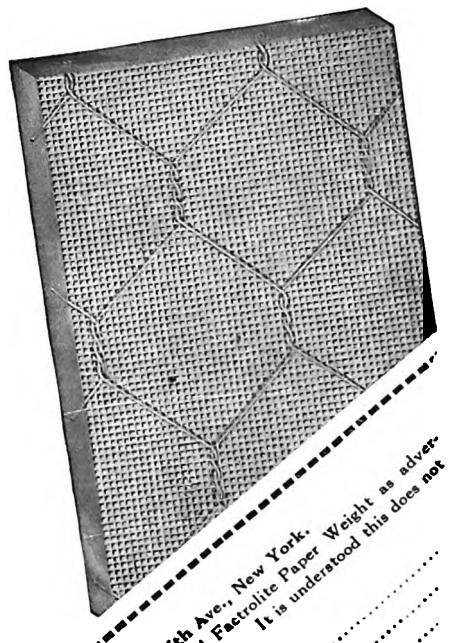
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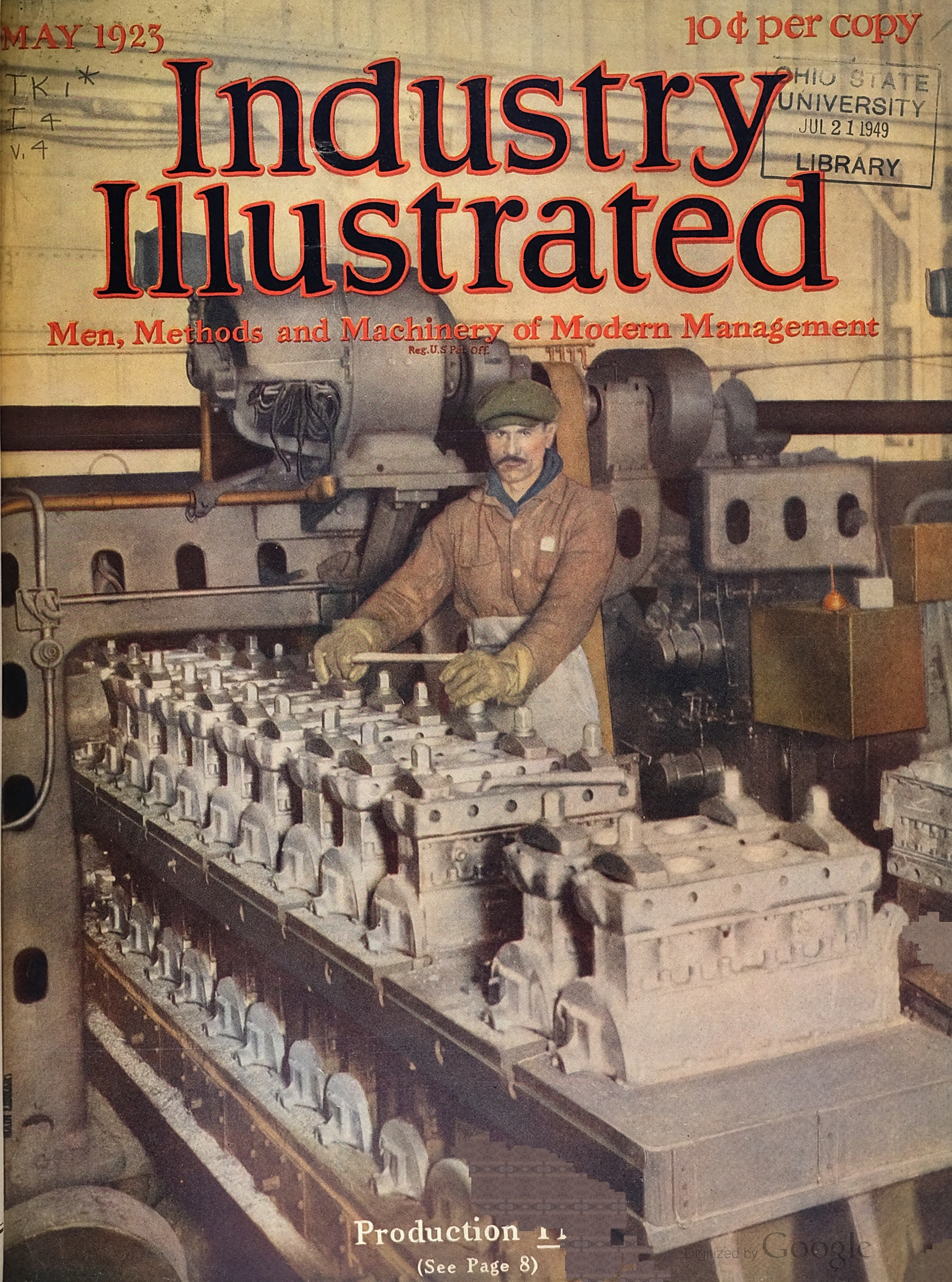
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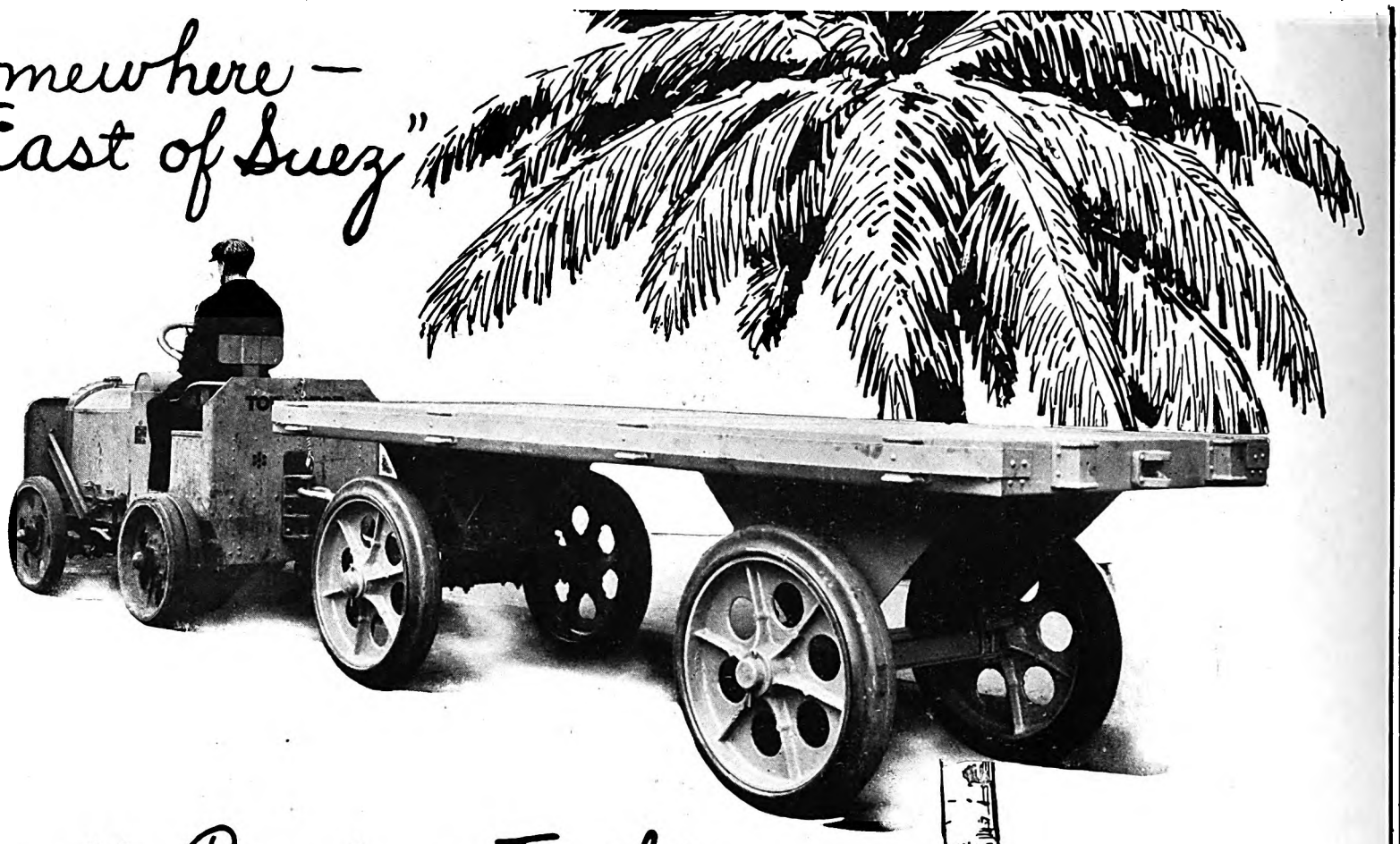


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(See Page 8)

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"East of Suez"



Hyatt Bearing Trailers Are Making Good

Eighteen of these husky, capable Hyatt bearing trailers are being operated by the Albion Dock Company, Port Louis, Mauritius Island (in the Indian Ocean).

To insure dependable trailer operation for this far off user the Towmotor Company of Cleveland built Hyatt roller bearings into their trailers. The elimination of bearing adjustment or replacement, so important to all trailer users, is of especial importance to a firm half way around the world from the source of equipment.

Dependability was of course the first consideration for this equipment but the additional Hyatt bearing advantages of easy running and lower lubricating cost are just as important.

The dependability and economy of Hyatt roller bearing trailers will materially reduce *your* handling costs—specify Hyatt equipped. All reputable trailer manufacturers are prepared to furnish you Hyatt bearing trailers.



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Industry Illustrated

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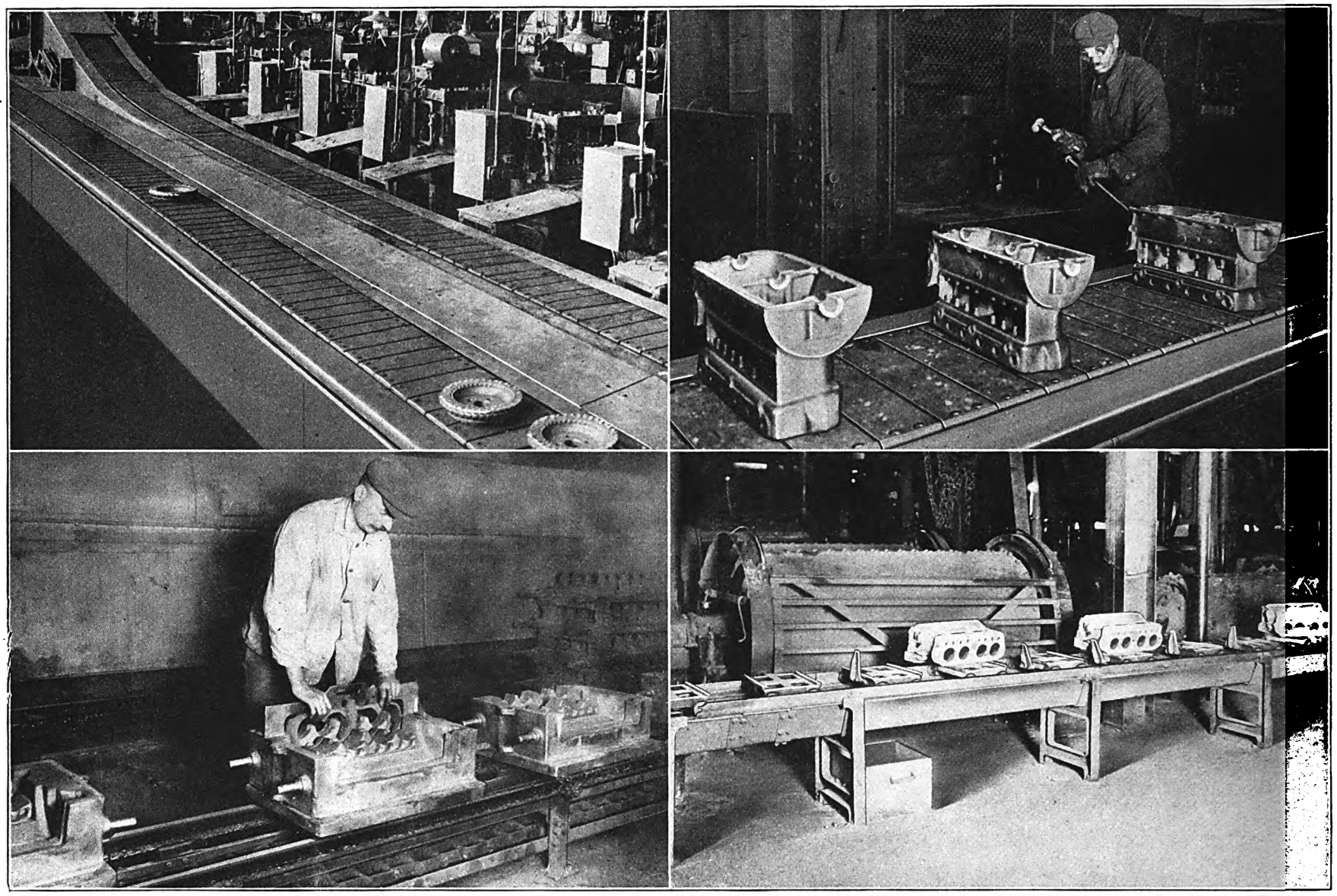
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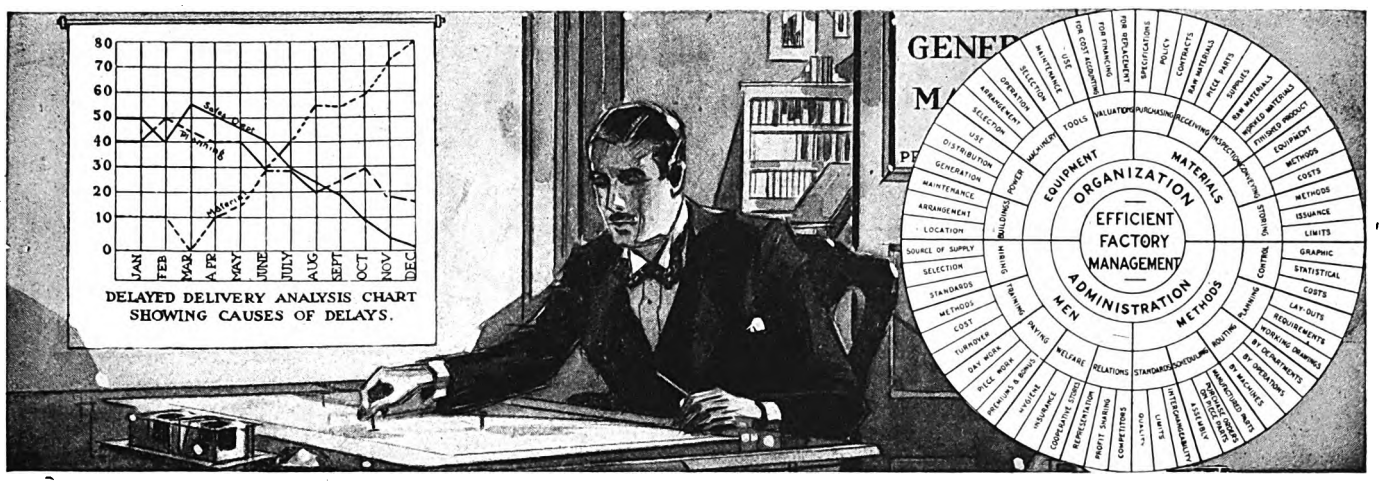
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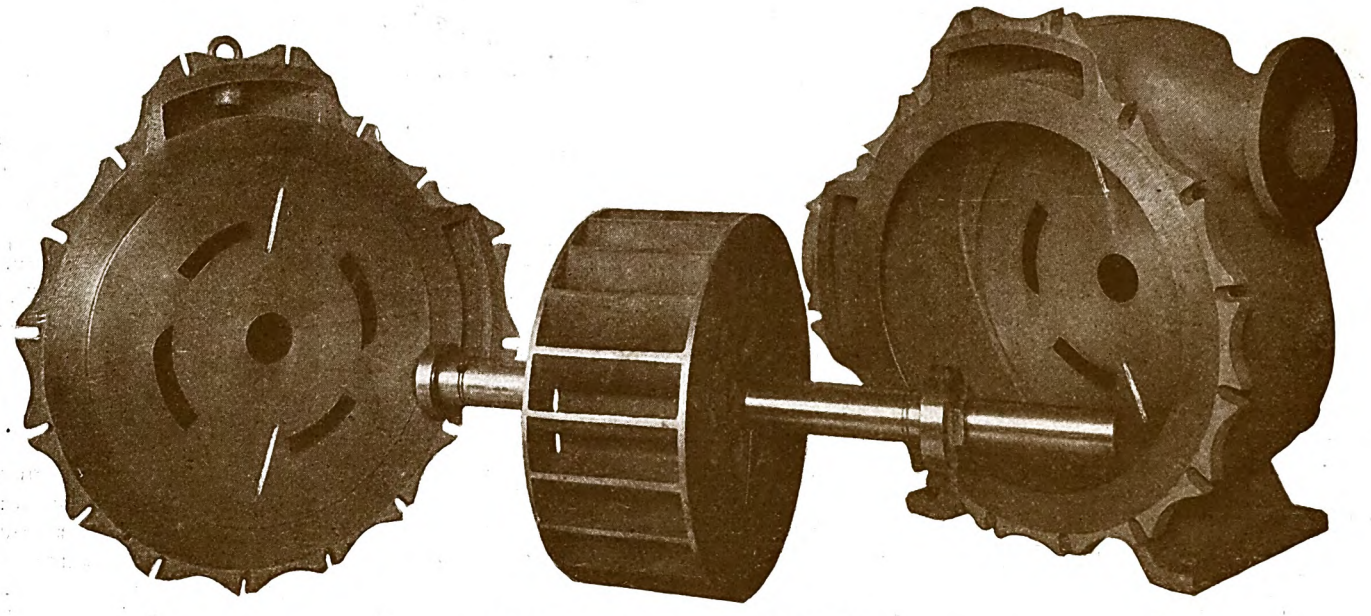
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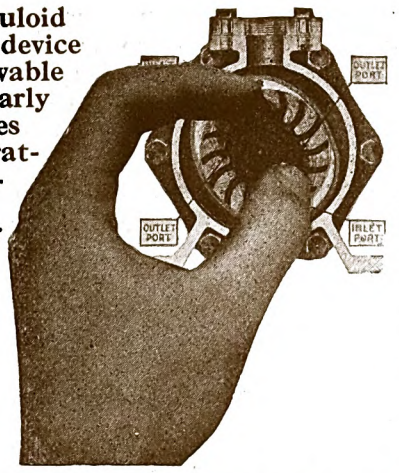
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The original high efficiency is maintained indefinitely in continuous service.

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Hytor compressors occupy very much less floor space and are much lighter in weight than reciprocating compressors They run without vibration.

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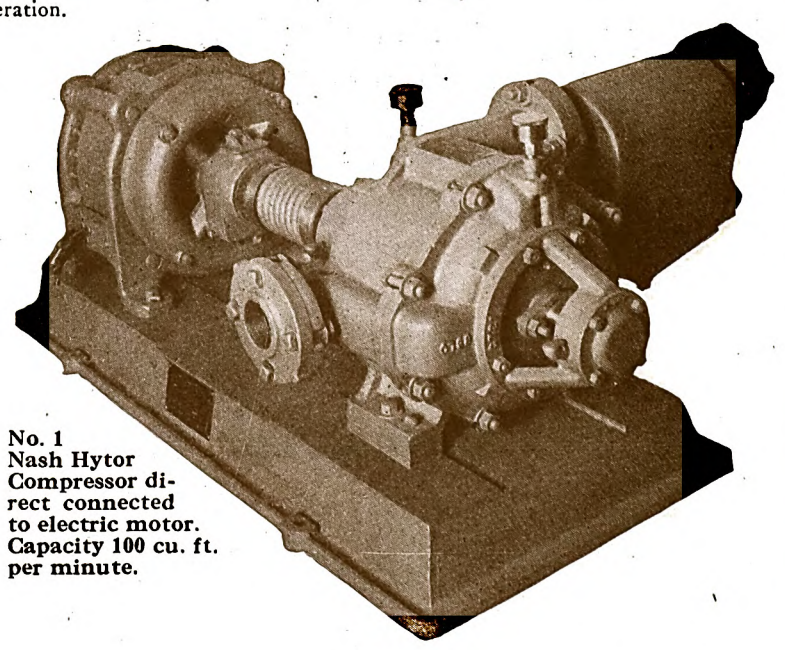
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No. 1 Nash Hytor Compressor direct connected to electric motor. Capacity 100 cu. ft. per minute.

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EDITORIAL

Buried Treasure

WE have scanned carefully the list of articles discovered in the three thousand year old tomb at Luxor. There are references to finely wrought thrones, chariots, alabaster vases—a wide variety of things; but, so far as present reports go, the discoverers found no conveyors, or cranes, or elevators.

The thought is by no means as fantastic as it may seem at first glance. The wheeled chariots, the furniture, and the textiles entombed with this Egyptian Pharaon, bear mute witness to the craftmanship and skill of this civilization of some thirty centuries ago. We know, moreover, that the building of the Pyramids would constitute a task of major proportions even today, with the aid of modern machinery. How these immense monuments were constructed; how the huge blocks of stone were quarried, shaped, transported, and set in place; these are things which we do not yet know with any degree of certainty.

Certain it is, however, that many discoveries and inventions of ancient times have been lost to mankind, through bigotry, vanity, or indifference. The much discussed "Pompeian red" is an example; another is the art of tempering copper; still another, the making of resilient glass.

The up-to-date manufacturer, when he thinks of these things, has but contempt for "those old fellows" who, through ignorance or mental laziness, or lack of appreciation, failed to cultivate and to promote such valuable inventions. But tolerance, like charity, might begin nearer home; for that same ignorance and mental laziness is just as much in evidence in the present century, as in all the centuries that went before.

Right here, in our own progressive country, is a glaring example of this. We have grown accustomed to thinking of the science of materials handling as a new science—a development of the past thirty, or at most, forty years. Yet, if you will turn to the article which appears on page 14 of this issue, you will discover that belt conveyors, screw conveyors and elevators were not only invented, but were in actual use in grain mills in this country one hundred and twenty-eight years ago.

Not only was this materials handling equipment in use, but it had already proved its power to save money, time and labor, away back in 1795. What, then, accounts for the failure to extend and promote its use; why was there so little advance made in a whole century; why did not the coming of steam power make the use of materials handling equipment universal?

It is safe to say that not one man in a thousand who reads these lines, but is thoroughly informed on the discoveries made in the tomb of a king who died over three thousand years ago. We are inclined to suspect that it is equally safe to say that not one in one hundred, of our executive readers, is thoroughly informed on the much more immediate and profitable discoveries that would result from a close scrutiny of the materials handling methods right in his own plant.

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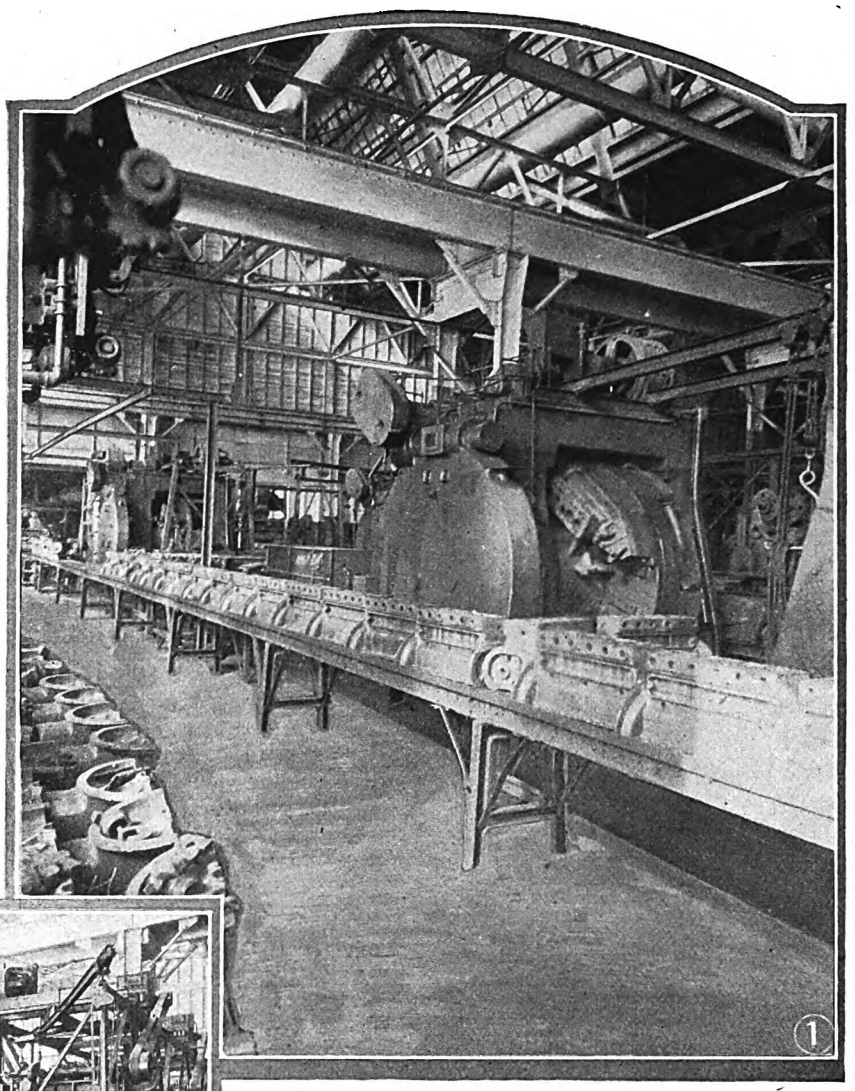
Machining Operations at Ford's River Rouge Plant

By John H. Van Deventer

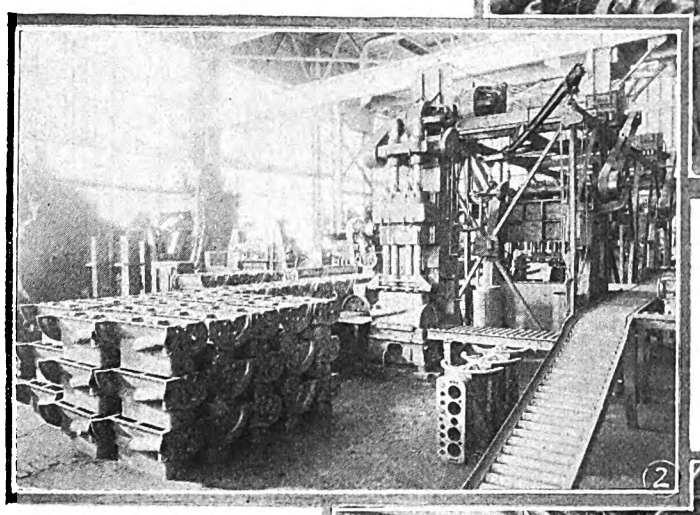
ONE becomes accustomed to encountering the unusual at the plants of the Ford Motor Company and also to finding substantial reasons for things being done as they are done. It is rather unusual to find a machine shop housed in the same building with a foundry. All of the iron castings produced at the River Rouge foundry, where fifteen hundred tons of metal are poured daily, are machined under the roof of the same building in which these castings are molded. This relationship, however, is a logical one when you consider the Ford principle of maintaining production in uninterrupted flowing streams from start to finish so far as possible.

In a previous article* we followed the course of production in the making of castings and found it an unbroken chain from the origin of the embryo core to the finished casting, ready to be machined. Our present story begins where the last one terminated, and takes the casting via an almost uninterrupted system of conveyors through the machining operations to the car loading platform which forms the connecting link with assembly.

The machine department at River Rouge occupies a floor space of 150 by 1200 feet, running lengthwise of the eastern portion of the foundry building. It is separated from the foundry proper by walls through which openings are provided for the transportation of castings. Thus the machining area is actually a long rectangle flanked on either side by slat conveyors, which run nearly the entire length of the department. That on the western flank nearest the molding and cleaning operations is known as the rough stock conveyor. Both of these run from south to north. Between them are sharply defined groups of machine tools and appliances. Each group is devoted to the complete machining of a certain casting. Between the two long conveyors and running from west to east



Entering the machine shop at River Rouge from the foundry, Fordson cylinders travel on gravity roller conveyors to huge station type milling machines.

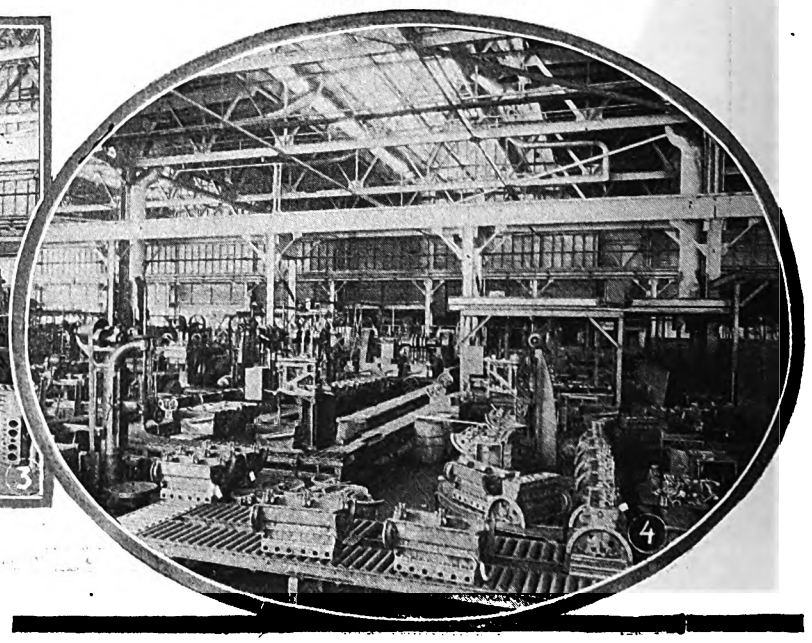


The tractor cylinders are bored and reamed on huge four-spindle boring machines. Note overhead works to facilitate handling the heavy castings.



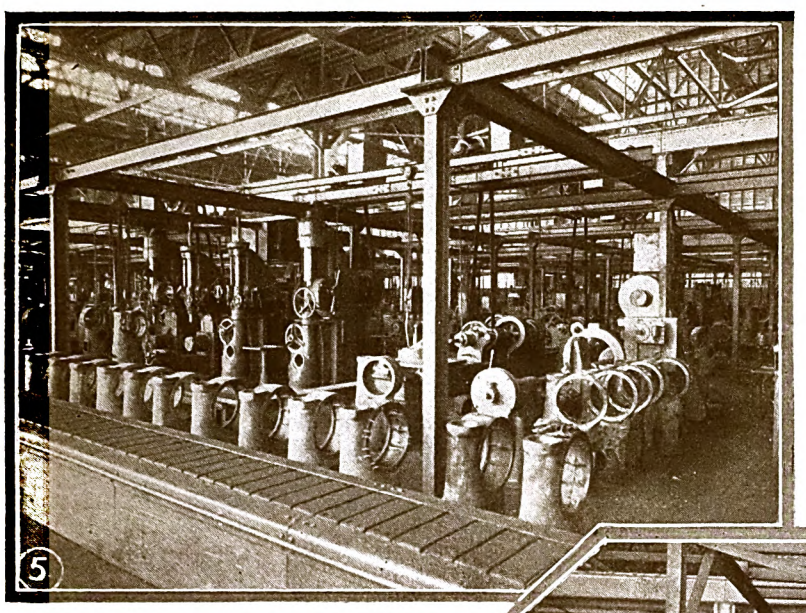
At the left of this picture are the tractor camshaft bearing drills, and at the right multi-spindle drills for tractor cylinder heads.

A study in inter-machine transportation. This is where the tractor bearing caps are babbitted.



* Industry Illustrated, January, 1923.

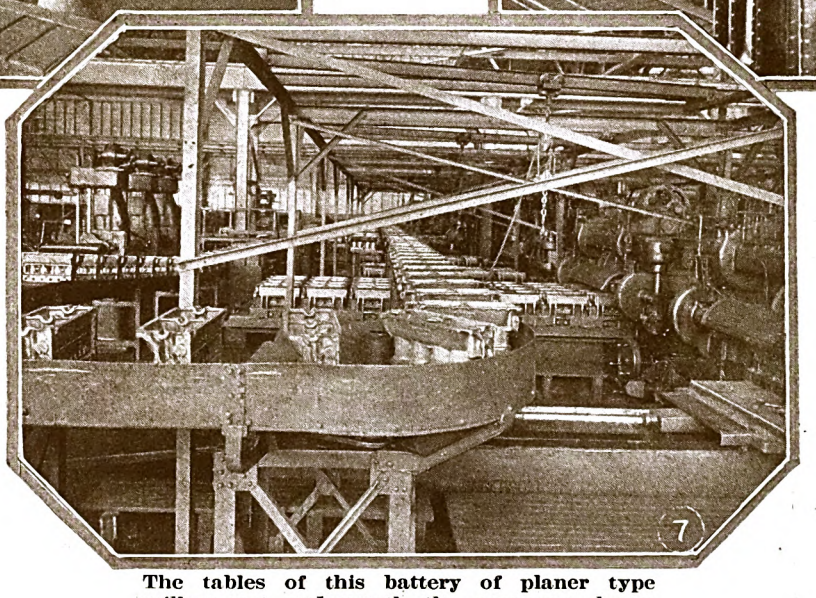
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Next, one comes to the tractor transmission housing job, as it is called, where axle flanges and transmission seat are bored and faced.

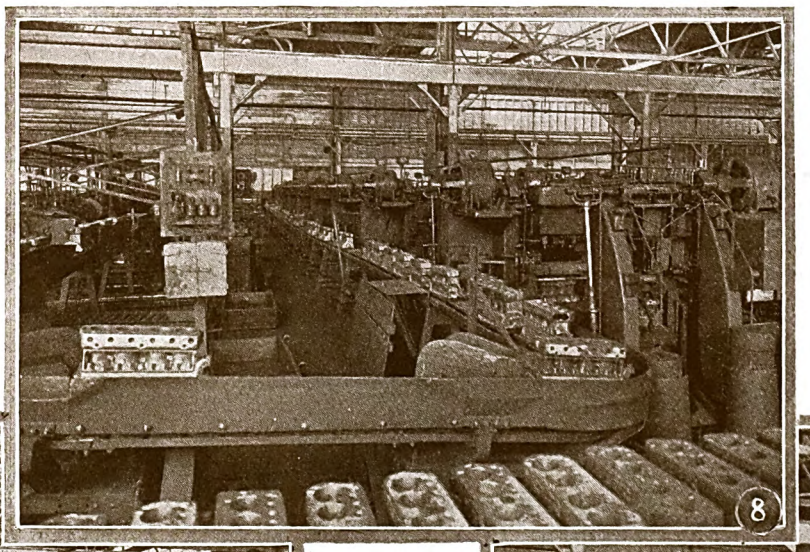


At the left of this picture is the tractor cylinder machine unit, and on the right station-type millers for machining tractor crankcases.



The tables of this battery of planer type millers run underneath the conveyor shown in the center of the picture. Note overhead works to facilitate machine loading.

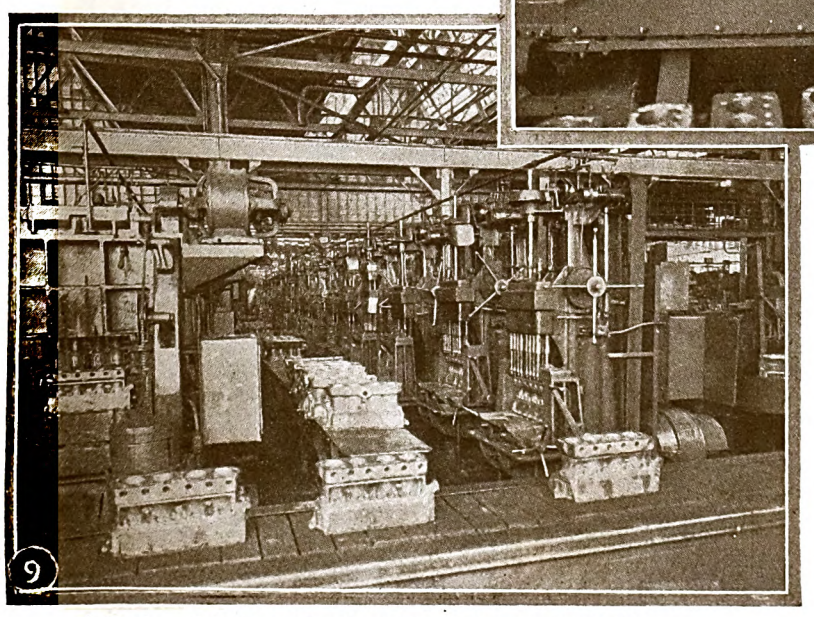
An endless procession of car cylinders passes by and feeds the battery of four-spindle boring machines which perform the rough boring operation.



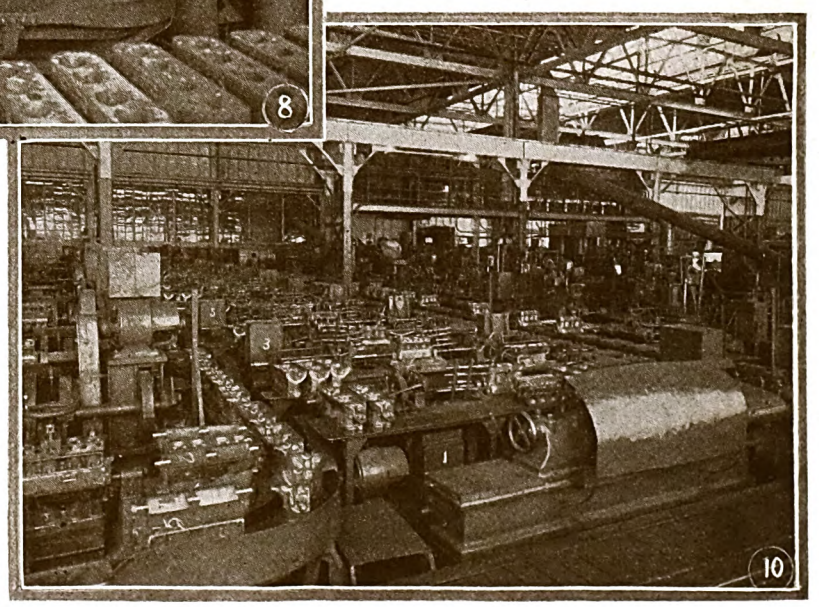
are countless inter-machine conveyors which carry the work in process from the rough stock conveyor and from one machine to another until it reaches the finished stock conveyor in a completed state.

The first impression of the visitor at this machine shop and for one who inspects carefully the pictures presented here is that the machines have been placed so close together as to scarcely leave space for the men to operate them. One who is accustomed to usual machine shop practice would indeed call this a most congested area. This, too, has been done in accordance with a Ford principle —the principle that, so far as possible, the work must move and the men stand still. Employees of this company are not paid for pedestrian ability but for production. The less steps they have to take, the less time will be taken from production. And so practically all the steps are taken by conveyors which vary from elaborate, motor-driven, especially designed "easy chair" chain drags for the accommodation of cylinder blocks, to simple runways made of angle iron down which tractor pistons roll of their own weight.

The closer that machines can be placed, the less the total length of conveyors required for inter-machine work-handling. Thus, a saving of but six inches per machine is of utmost importance when a shop is dealing in production figures such as are dealt with here. Every twenty-four hours, complete castings are machined for five hundred Fordson tractors and in addition to this *five thousand cylinder blocks* for Ford cars pass through some forty-three separate operations. Hence, a square inch of vacant floor

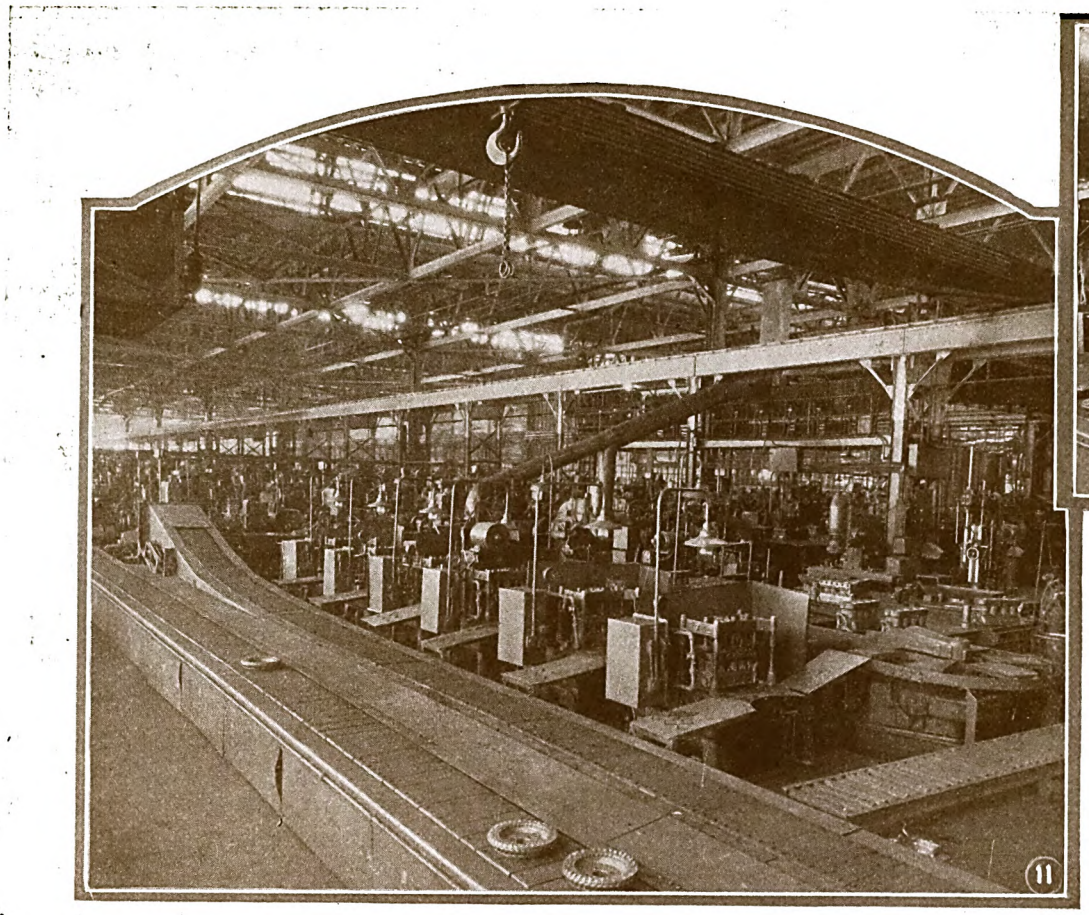


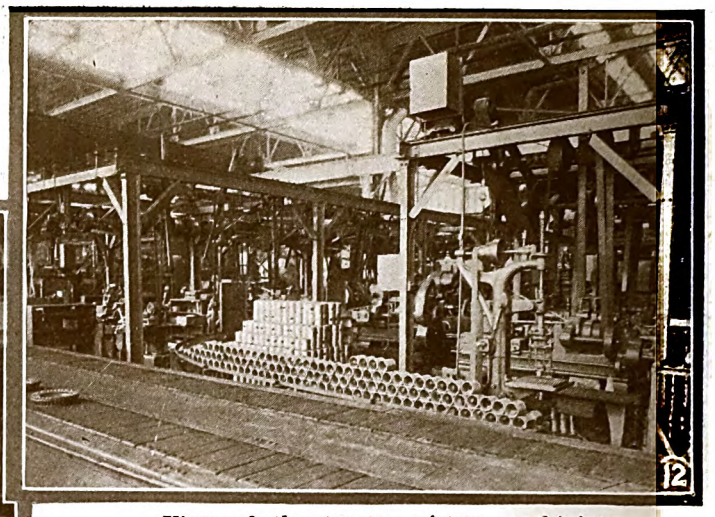
Push rod holes and valve stem holes on the T-400 are drilled and reamed on the battery of multi-spindle drills shown in this picture. At the left is the cylinder reaming operation.



A veritable forest of drills and reamers is pictured above. Here are the camshaft boring lathes for the Ford car cylinders.

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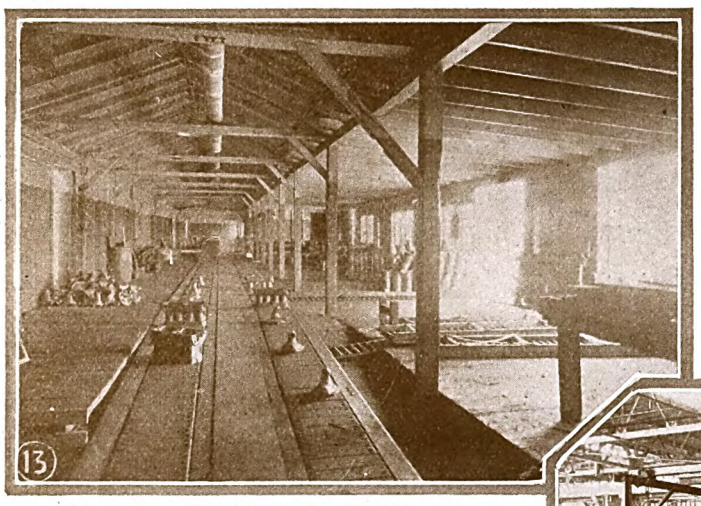


View of the tractor piston machining unit. Group drive is employed for the smaller machines, hence the overhead beam structures.

space is regarded as an enemy destructive to profits.

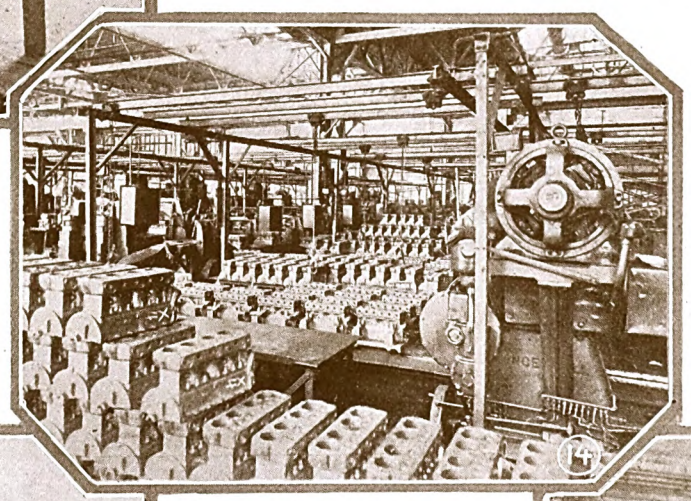
The first thirteen pictures, which are presented in this article, were taken at successive points from south to north along the main aisle and adjacent to the eastern wall of the building. They are intended to give the reader the same impression as that received by a visitor who walks the length of the plant.

The first machining unit has to do with the tractor cylinder. In the first picture you can see a stream of these castings entering the machine shop from the foundry on a gravity roller conveyor. Inside of this conveyor are huge station-type milling machines where the cylinder tops are faced. Next we come to the boring operation performed on four-spindle boring machines. A good idea of the inter-machine conveying system is given by this second picture. In the third view we note a battery of camshaft boring lathes and at the right of the picture multi-spindle drills for drilling tappet and valve stem holes.

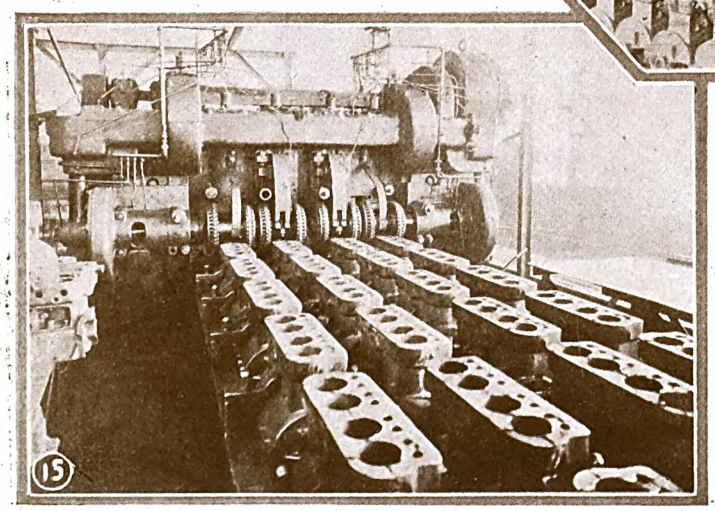


The wood slat conveyors in the foreground transport the entire output of finished work to the shipping platform. Just back of the second conveyor is the battery of hydraulic cylinder testing machines.

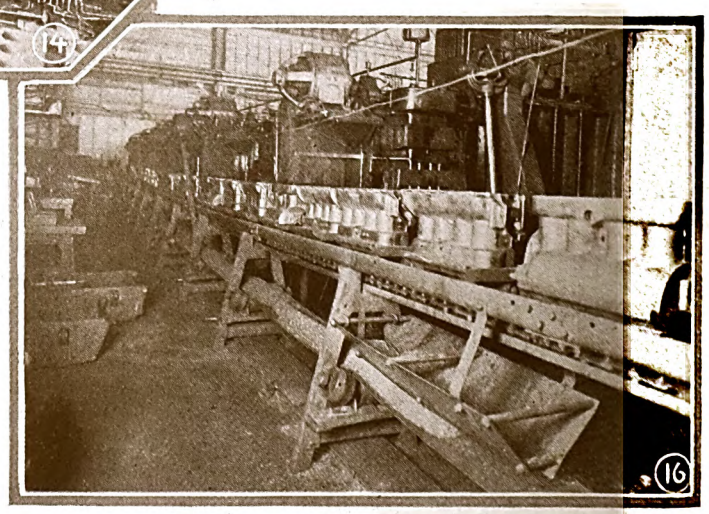
At the north end of the building the finished stock conveyors enter the shipping platform. Gravity roller conveyors on either side lead to car loading doors. Thousands of tons of finished castings pass through this place daily.



The second milling operation is done on the cylinder top and sides. This shows a battery of machines employed on this operation.

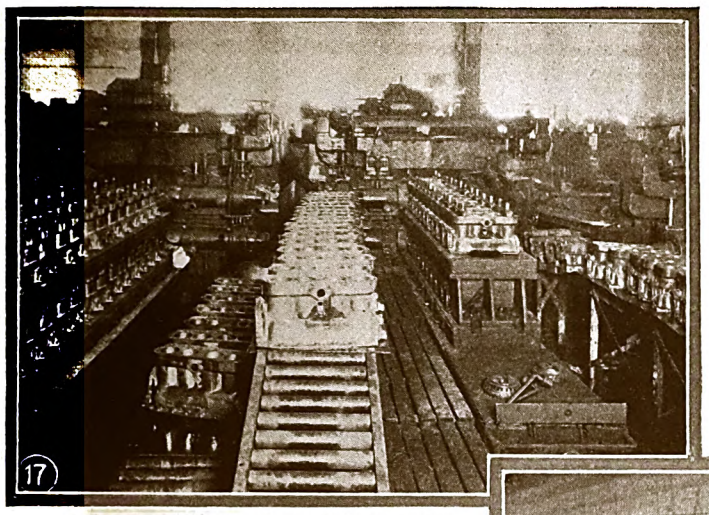


Work-holding fixtures are simple yet effective. All of the principle machine tools are equipped with multiple oiling systems.

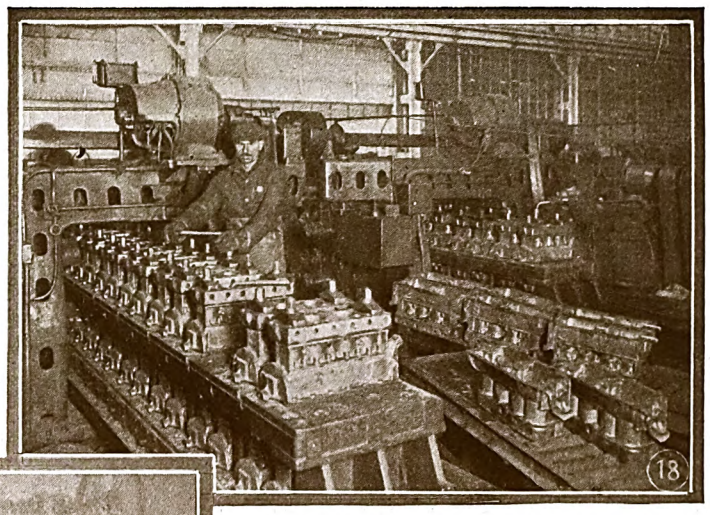


An interesting double conveyor installation. Underneath the chain drag conveyor which carries the cylinder blocks is a belt conveyor for disposing of chips.

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Maximum utilization of floor space might well be the title of this picture. At the Ford machine shop the work moves and the men stand still.



Milling two sets of cylinder ends at one pass is effectively accomplished by means of a "second story" added to these miller tables.



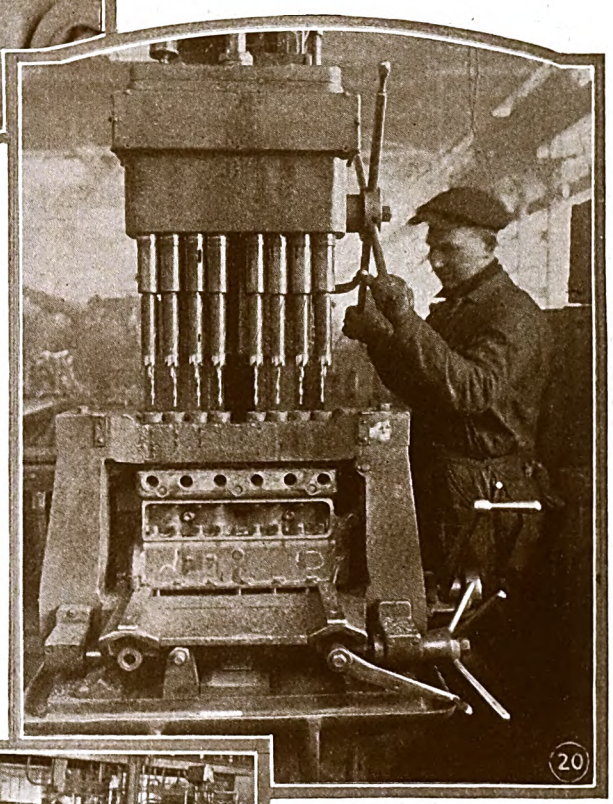
In the middle foreground is shown the special machine used for line reaming the crankshaft bearing hole.

Walking along a few yards further we come to the main bearing babbitting operation shown in Fig. 4. Notice that all of these conveyors are arranged to bring the work to the most convenient operating height.

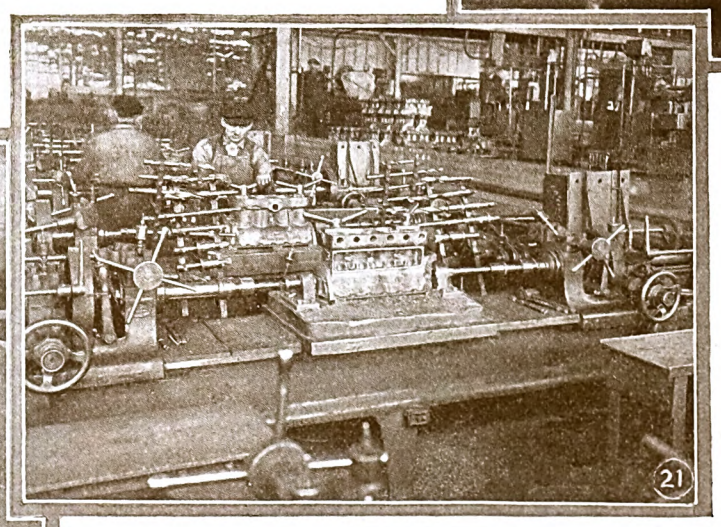
Passing along still further one sees a group of heavy single spindle boring machines engaged in boring and facing large diameter holes in the tractor transmission housings. As this section of floor space is devoted to castings of considerable weight, overhead handling facilities are provided to obviate hand lifting.

Just beyond the tractor transmission housing "job," as it is called, is a unit for machining the tractor crankcase. You can see this unit in Fig. 6 and also in the foreground the finished stock conveyor of which I spoke previously.

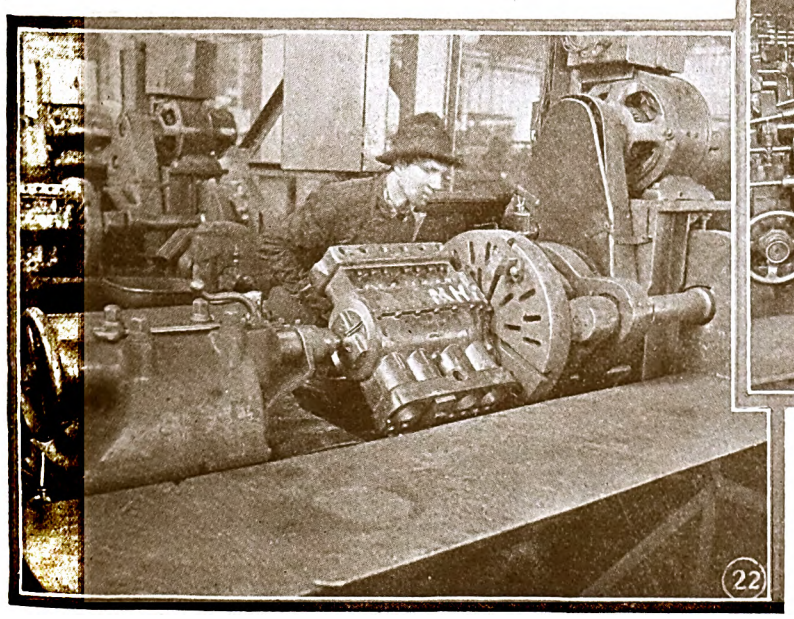
And now we come to what is the busiest and most interesting section of this busy and interesting machine shop—the unit which takes care of ma-



On this eight-spindle drill tappet holes are drilled and valve holes bored and faced.

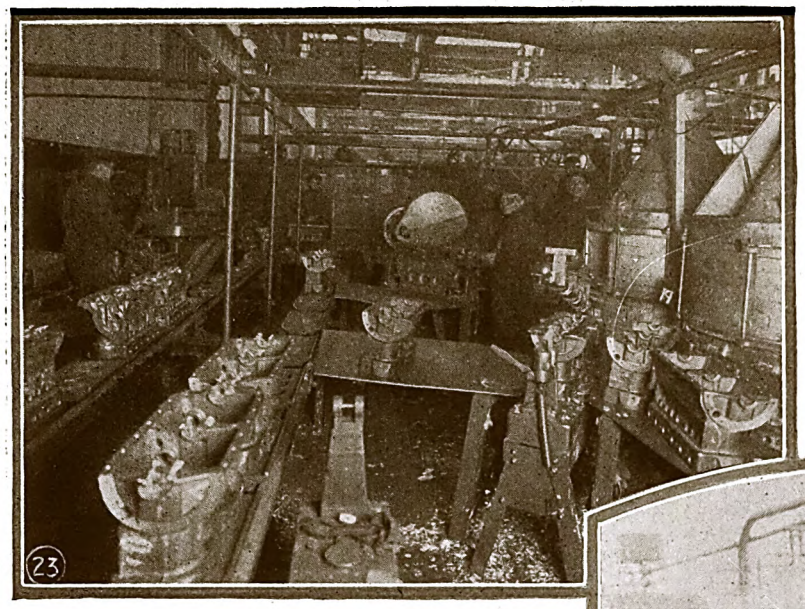


Drilling and reaming the T-cylinder camshaft hole is a delicate operation that required a succession of small holes. Note the convenient tool-holding racks.

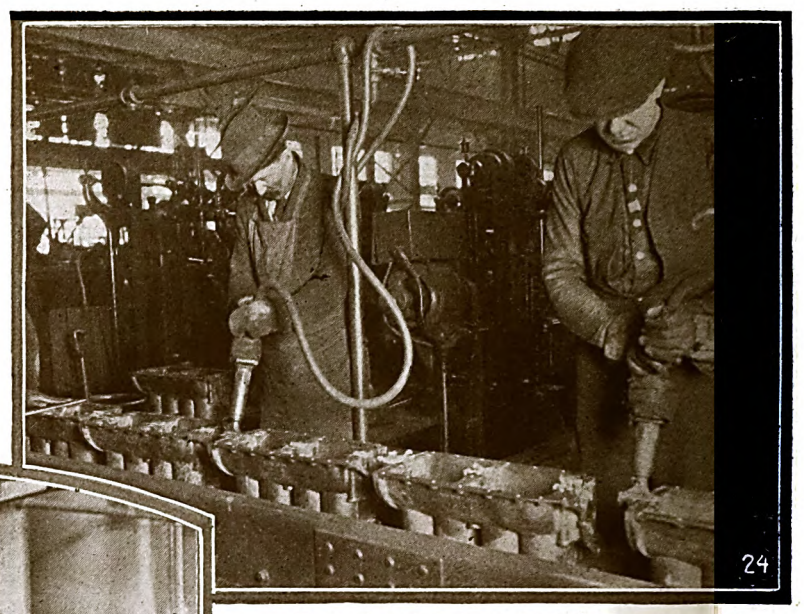


The transmission flange is turned and faced on two cylinders at a time securing perfect circular alignment with the camshaft bearings.

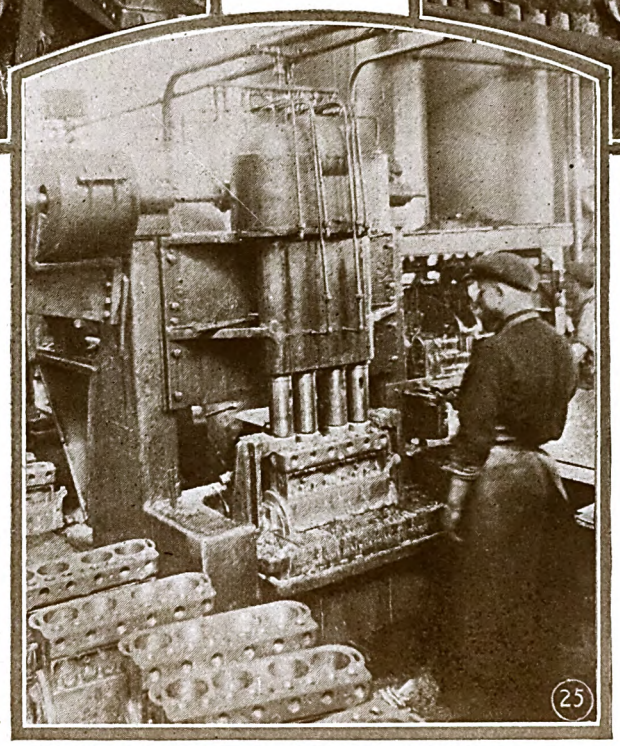
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Fifteen thousand bearings are babitted in this department every twenty-four hours. At the left are trimming machines which mill off fins and gates.



Each bearing is peened by means of a compressed air hammer as the cylinders pass this station.

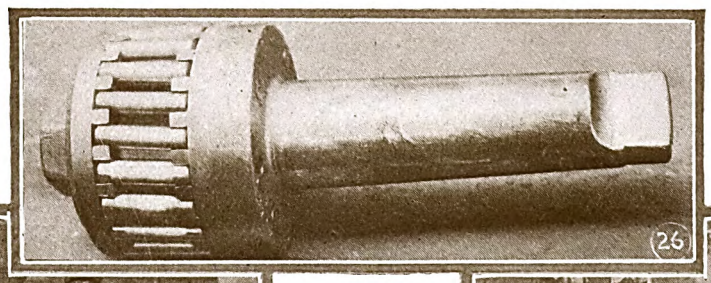


Ford cylinders are finished by rolling—not by cutting or reaming. This is really a swaging operation.

chining five thousand car cylinder blocks every twenty-four hours. The visitor is introduced to this unit by a glimpse of the battery of milling machines shown in Fig. 7. An endless procession of cylinders pass over the tables of these machines, providing the operators with a continual supply of rough castings for this operation. Next in our preliminary inspection trip we come to a battery of four-spindle boring machines where the cylinder holes are rough bored. Here also you will see the same type of work-feeding conveyor system maintaining an endless procession of cylinders past these machines. The next vista that catches the eye is a literal forest of multi-spindle drills stretching as far as one can see. These are shown in Fig. 9 and here the drilling and reaming operations on the valve stem, tappet holes and valve seats are performed. Each drill is provided with sixteen spindles, eight of which are in operation at a time; the two sets of spindles being utilized in succession by a lateral movement of the work-holding fixture. Here also you will note another form of conveying that reminds us of the ice slide of boyhood days. Work here is slid from one machine to another along a slippery sheet iron surface, elevated to work table height. The next picture, Fig. 10, represents the battery of camshaft hole boring machines that one encounters on walking some yards further. Notice how every square inch of floor space is utilized and how the work flows by on the various types of conveyors provided.

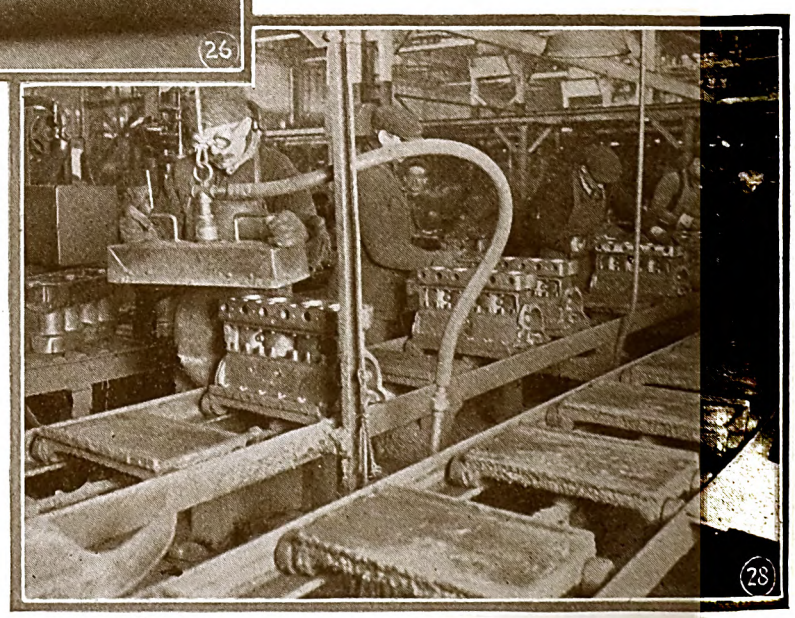
The next view in Fig. 11 is that which one would see by walking a hundred yards further north and then looking backward. In the foreground

Here is one of the swaging tools that rolls the cylinder bore to its finished size, giving the metal a hard, glassy surface.



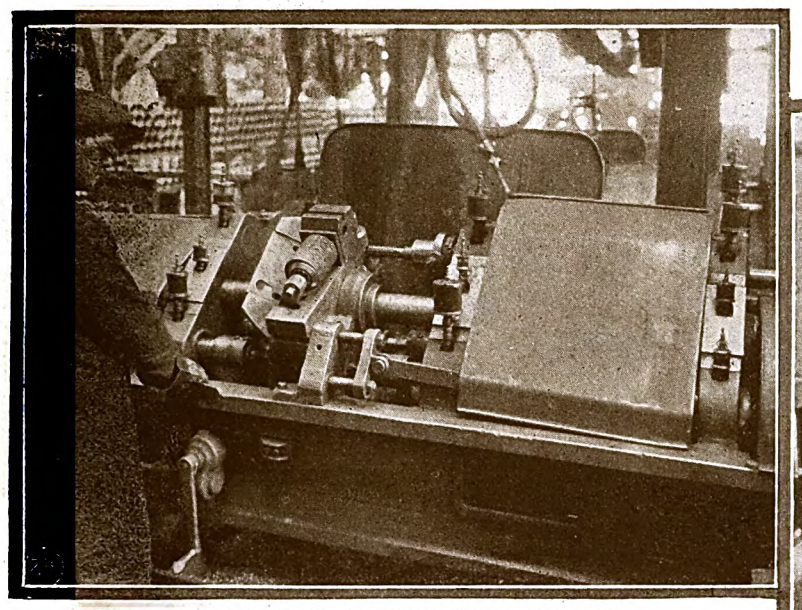


Near the end of their journey the T-cylinders pass through an automatic washing machine which removes oil and grease.



This is called the inspection conveyor. The operator at the left is blowing out the port cavities, and the inspectors at the right are checking up on size and finish.

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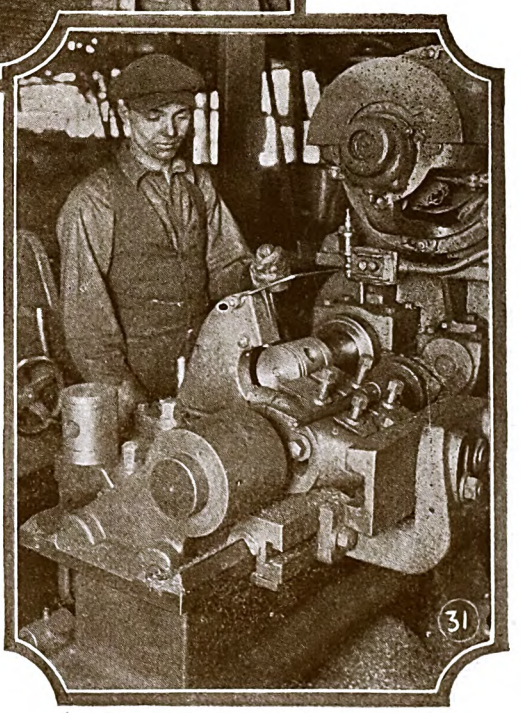
Next comes the boring and rough reaming of the piston pin hole.



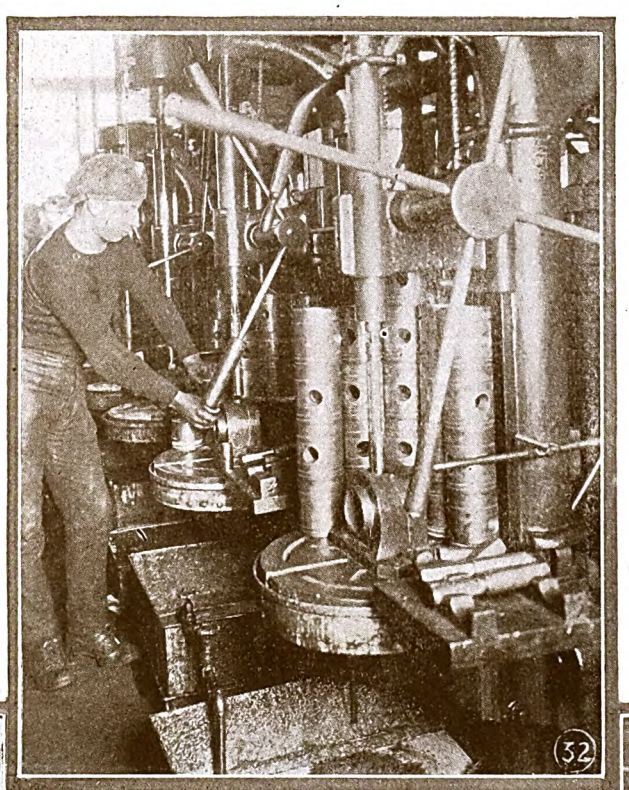
The rough turning, grooving and facing on the Fordson pistons is accomplished on a battery of automatics. At the right is the simple piston gravity conveyor made of two angle irons.

are the finished stock conveyors. The longer of the two stretches for nearly a third of a mile. Normally these conveyors present the appearance of an Atlantic City broadwalk procession with the difference, however, that the movement is in one direction only and of finished castings instead of people. This photograph was taken on a Sunday. After the last shift has gone off on Saturday night there is very little of accumulated left-over stock to be seen. This is a striking tribute to the ability of properly designed conveying systems to keep a plant cleaned up and thus to minimize the stock-in-process investment. Just back of the second conveyor in this picture is the battery of hydraulic testing machines where each cylinder is put under pressure to detect blow holes, leakage and porosities.

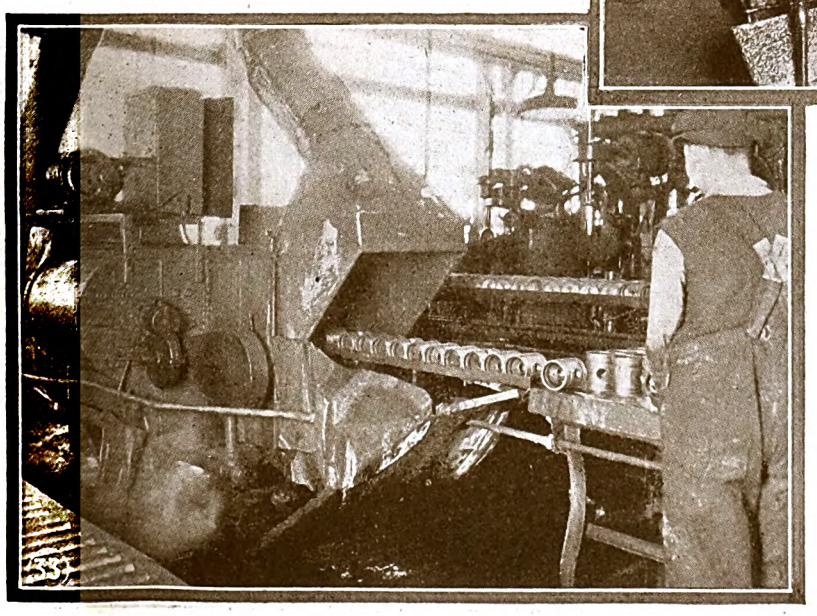
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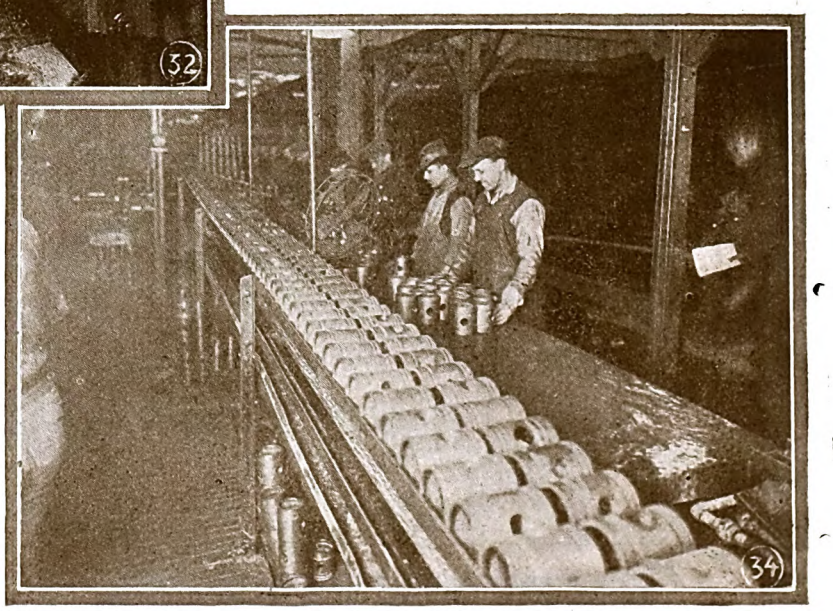
Rough turning the pistons is accomplished on the semi-automatic tool shown above.



Piston pin holes are line reamed to finished size on drills as shown at the left.



After the machining of the tractor pistons is complete they are passed through a washing machine and thoroughly cleansed.



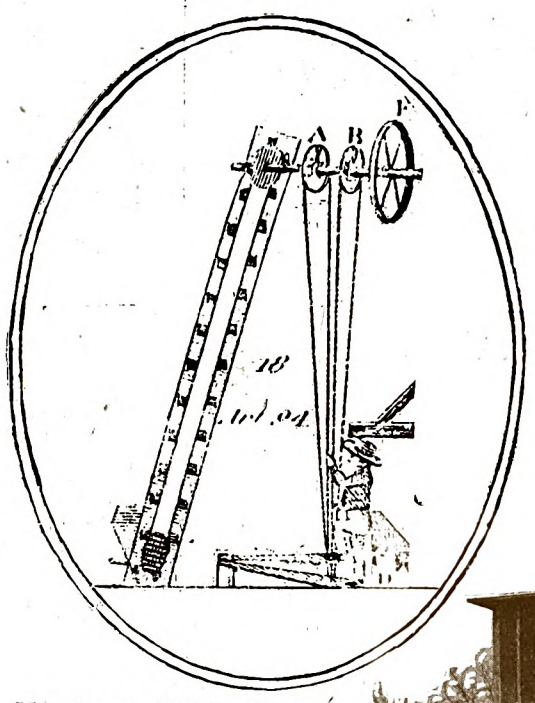
As the finished pistons roll past the inspection table they are checked for size and the piston rings are fitted.

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A "New" Science, More Than Five Generations Old

The Comparatively Slow Progress Made In Materials Handling in 128 Years

BY MATTHEW W. POTTS



Man-power bucket elevator, as designed by Oliver Evans in the year 1795. It is crude but effective.

Materials handling is a subject that will be discussed by engineers and plant executives as long as production is a factor. The rush of war production made it necessary to turn to mechanical equipment to speed up the handling of materials in nearly every industry. In order to meet this demand, the manufacturers of materials handling equipment had to design and develop new types; which led to the belief, in the uninstructed mind, that the whole science was a new idea and an experiment.

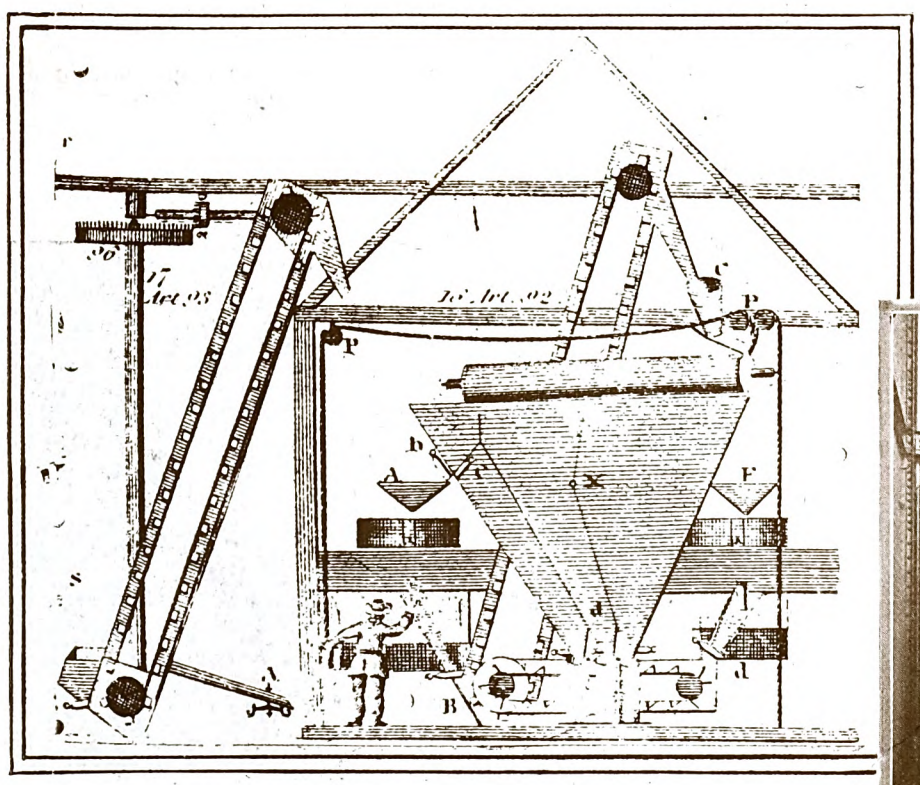
Illustrations on this, and the facing page, show very plainly that this is not so; that, in fact, the idea and its application have been known and used for more than a hundred years right within our own country. Looking at some of the more modern pieces of equipment, as illustrated, it will be seen that the principle of operation is the same.

To be sure, many new ideas have been added; but a search back through old engineering works has proven that it is difficult to find any really *new* development, other than mechanical improvements or fineness in construction details.

The manufacturers of this equipment now have a wonderful opportunity to promote the more extensive use of their

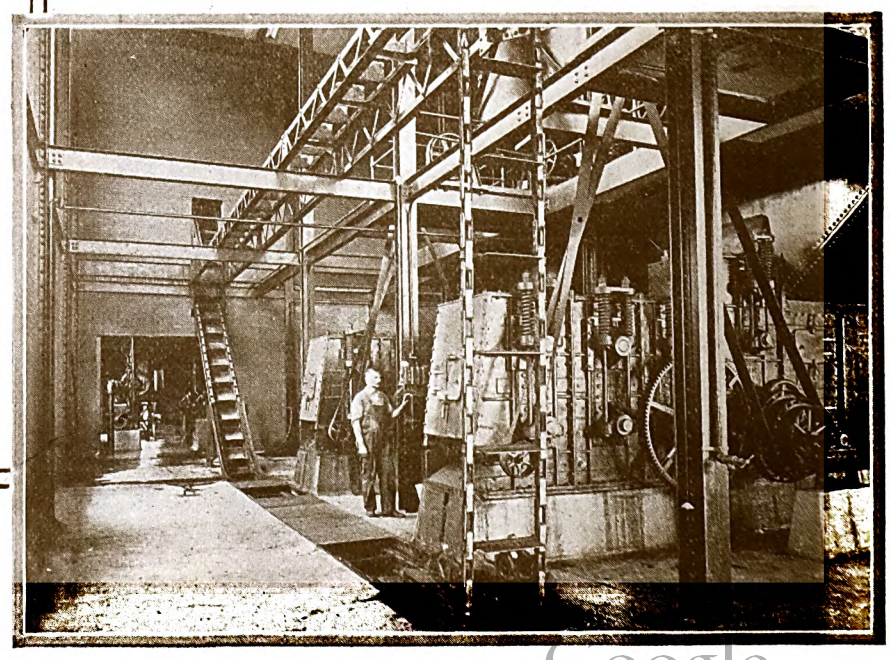


A modern plant. It is amazing, the diversity of places where materials handling equipment is called upon to operate. This picture was taken in the year 1921.

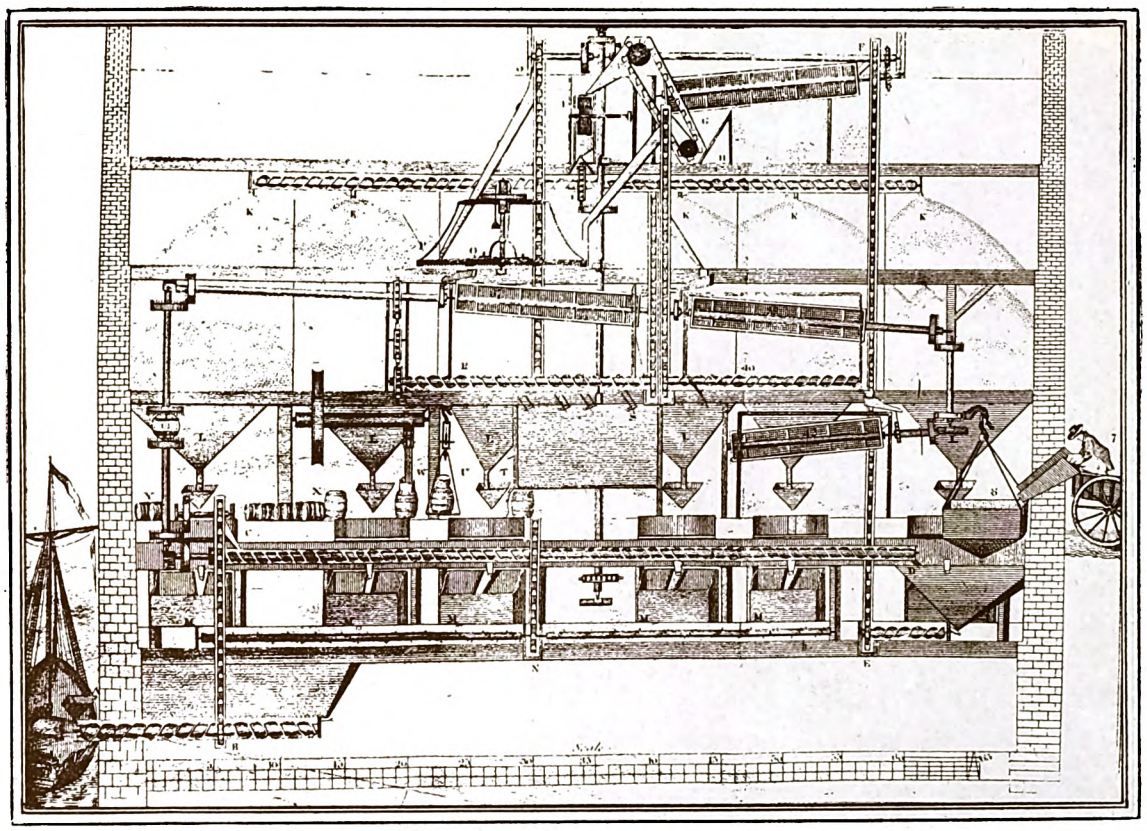


This complete mill is operated by one or two horse-power. Note the flight conveyor to the right of the man and back of sack fillers. (This illustration is also taken from Oliver Evans' book published in 1795.)

A modern chain flight conveyor operating in a garbage disposal plant. This equipment is of better mechanical design than the one shown in figure 3, but the principle is the same.



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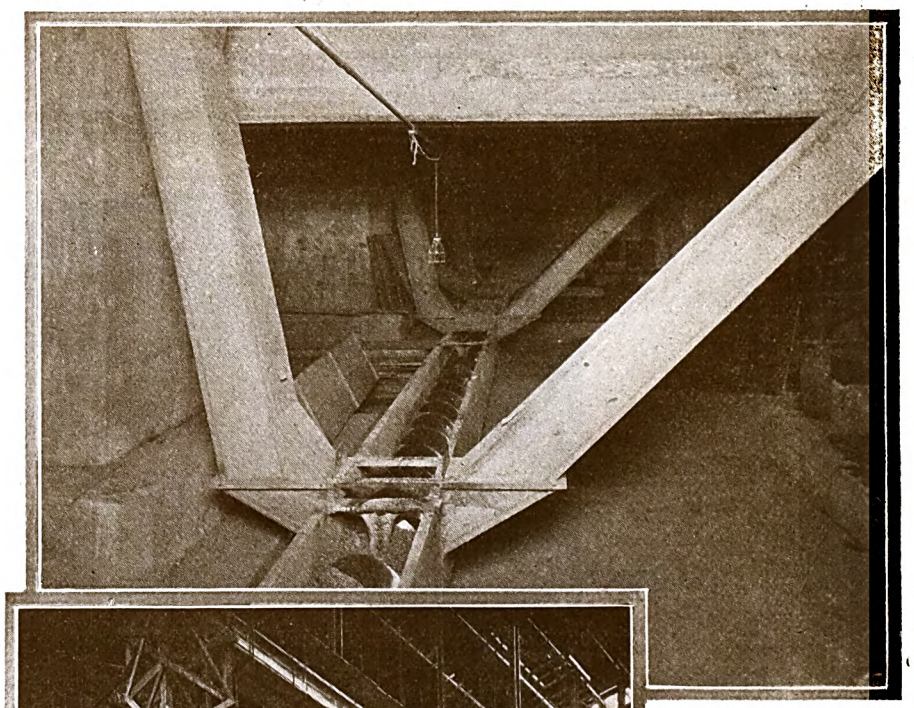
Elevators, screw conveyors, beam scales, and revolving screens, as applied in the year 1795. Grain and meal were the first materials successfully handled by mechanical equipment. Today, all terminal grain elevators, feed mills and flour mills are equipped with the most modern materials handling equipment.. This old wood-cut is of historical interest.

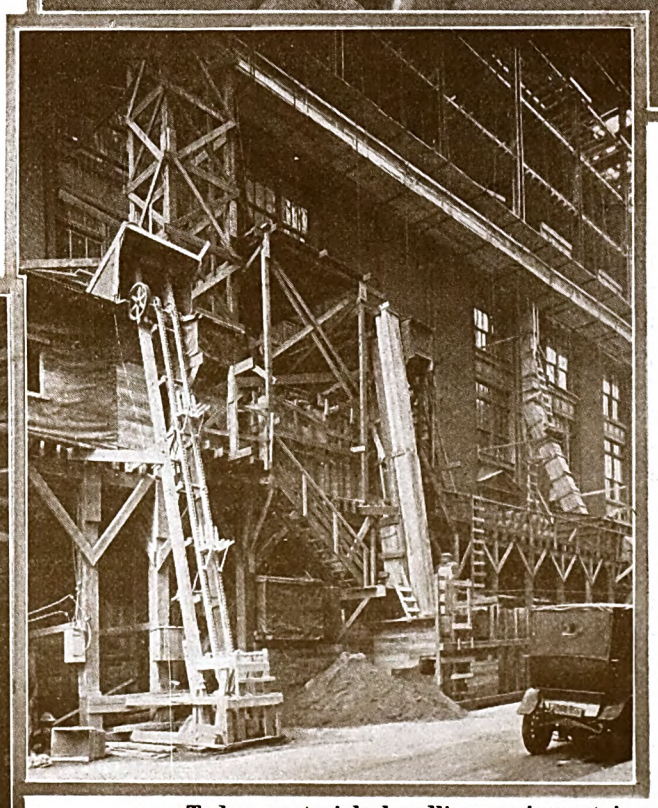
product. In all the trade papers, technical journals, and even in the public press, there is talk of a labor shortage, especially of common laborers and the class of men that are now used for handling the materials between successive operations and in process. It is advocated by many to relieve this dirth of manual laborers by changing the present 3% immigration law. It must be evident, however, that this would only be a temporary relief and one that would not help to eliminate the objectional features now connected with materials handling. These are: large labor forces, which help to increase labor troubles and labor turn-over; heavy lifting, which often results in injury to the laboring man; heavy hauling and energy-destroying work which entails a hazard because it brings on fatigue, often resulting in serious accidents.

It is strange that plant executives still have to be told of the many advantages that can be obtained by using mechanical equipment. They should instead be continually pressing the manufacturers of this equipment for new developments and detailed data regarding the operation of the present standard machines.

Looking at the accompanying illustrations, the reader will receive a fair idea of the diverse operatons that can be performed by one form or other of materials handling

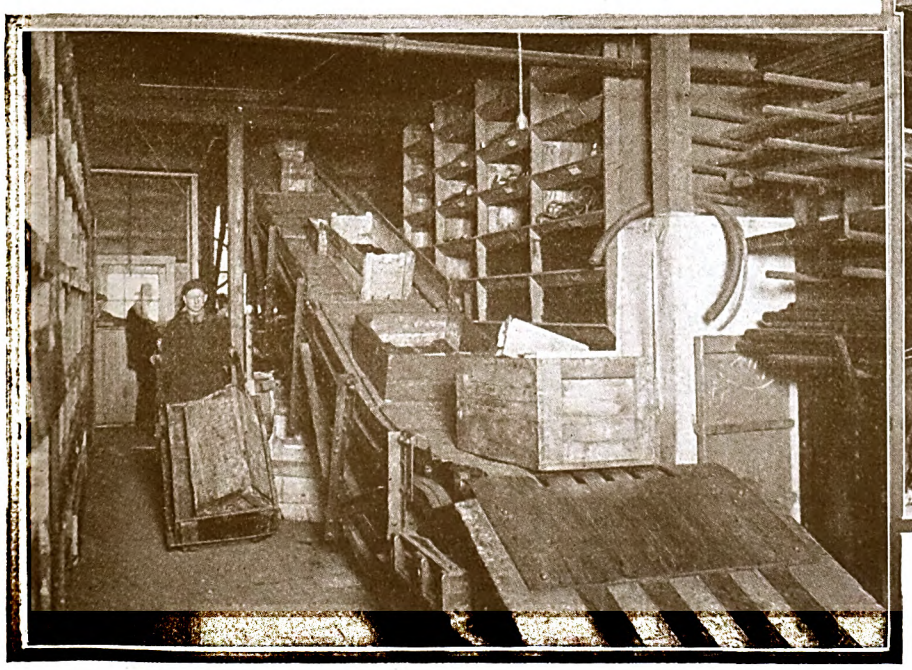
The modern methods are not so very different. At the right is a screw conveyor in a large milling company.. Various kinds of wheat are fed through these chutes, into the conveyors, where they are thoroughly blended and then carried to the mills. Thus the equipment performs two operations.





Today, materials handling equipment is not limited to the handling of grain, nor is it limited to any one industry., One of these elevators carries bags of cement to the mixer and the other elevates sand. In this way the heavy work is taken care of on the modern construction job.

The foot end of a wood apron conveyor which carries material from storage room to machine shop in an industrial plant. The conveyor is reversible, for carrying materials from shop to storage, thus serving as a carrier in both directions.



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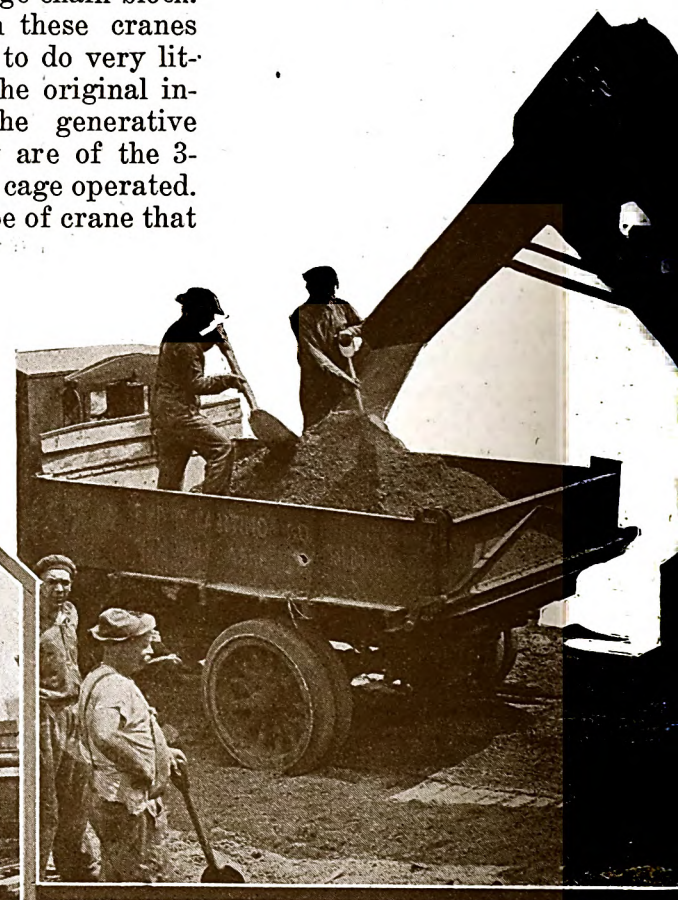
Portable conveyors are now doing a number of difficult piling and loading operations. This conveyor, piling sugar, is a great saver of money, time and space. It requires the same number of men to place the top bag as it took to place the bottom bag.

machinery. It is possible, with the various pieces of apparatus shown, to handle anything from a small grain of sand or wheat up to a 25-ton truss, and even heavier loads can be accommodated. The designs run from the simplest form of mechanical equipment, such as a single-strand chain-and-bucket elevator up to a 125-ton, 6-motor crane.

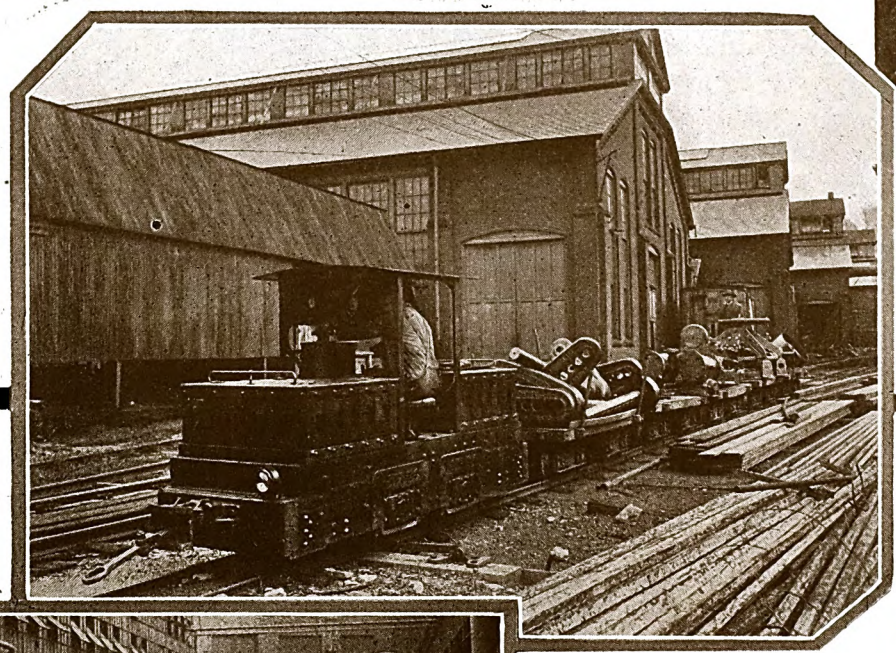
Fifteen years ago, most power house cranes were hand-operated and were little more than a pair of I-beams on wheels and a large chain block. Today, although these cranes are called upon to do very little work after the original installation of the generative equipment, they are of the 3- or 4-motor type, cage operated.

This is the type of crane that is now being used in heavy industrial service. It is known as a 125-ton, 6-motor double trolley crane. Each trolley has a capacity of 62½ tons and there is an additional 5-ton auxiliary. The main hooks have a lift of 40 feet, and the auxiliary has a lift of 80 feet. The installation shown on page 17 is in the TMER&L Co.—Lakeside Power Station. This might be called the one extreme of materials handling equipment.

In passing from this to the



Electric locomotives move materials about the yards in many large industrial plants, and equipment of this class has a big field in the mining industry.



American genius has adde
elevator principle. This wage
material and automatically d
operator simply moves the k
to shift i

It might be said that "materials handling equipment serves us while we are alive and after we're dead." This overhead monorail is handling tombstones.



Lift-platforms with hand and electric storage battery lift-trucks are reducing the cost of handling. The loading and unloading of materials from hand trucks is an unnecessary expense.



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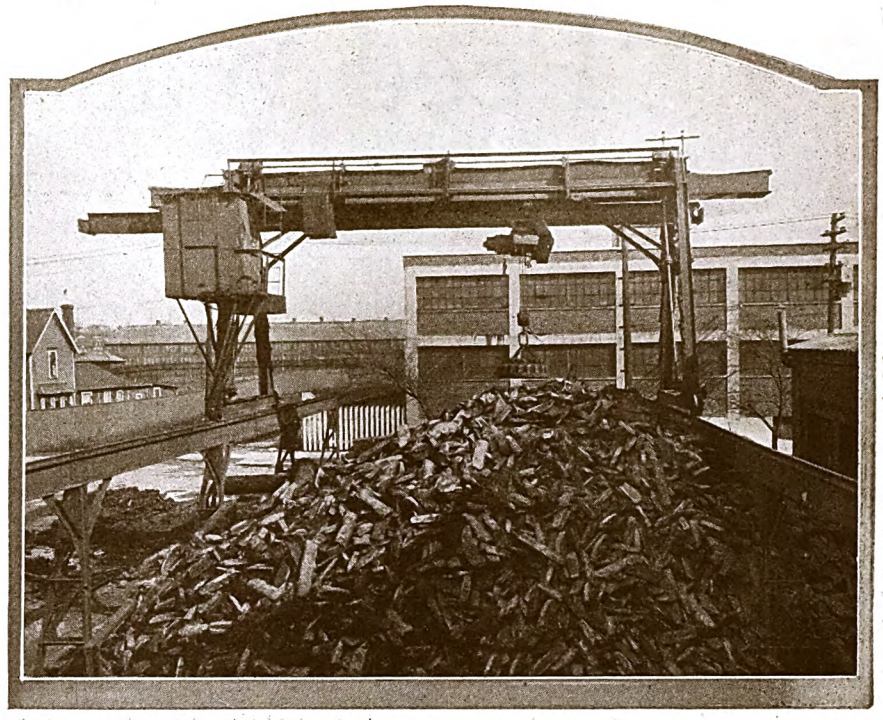
opposite extreme, we will turn to the second illustration on page 14. This mechanical equipment is doing an entirely different service, but without a doubt the installation of this simple elevator permitted the operator of this concrete block company to run his plant with at least 2 men less than would have been required had he decided to elevate his materials by hand.

The writer was very much interested in the wood cut, reproduced at the foot of page 17, because it shows so many pieces of materials handling equipment. The elevator to the left is operated by means of horse or team attached to a whiffle-tree and beam (see mark A). It is assumed that the other elevator, conveyor and mill stones are operated by power derived from a water wheel. The conveyor on the floor of the mill embodies the same principle as the modern flight conveyor shown at the right.

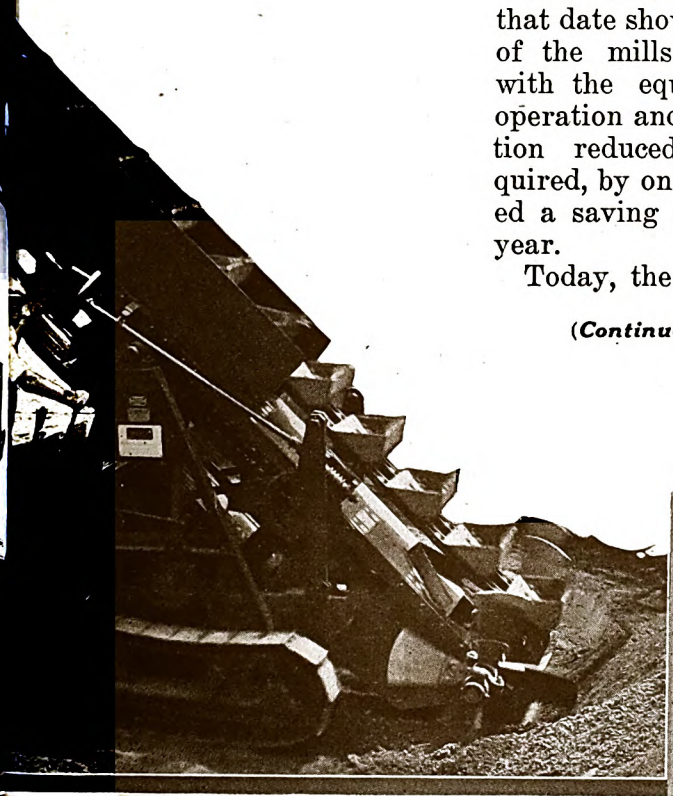
The cut at the top of page 15 shows the complicated layouts of material handling equipment that were successfully installed as far back as the years 1794 and 1795 in flour and feed mills. Testimonial letters of that date show that the owners of the mills where satisfied with the equipment and its operation and that its installation reduced the labor required, by one-half, and effected a saving of over $300 per year.

Today, the use of this class

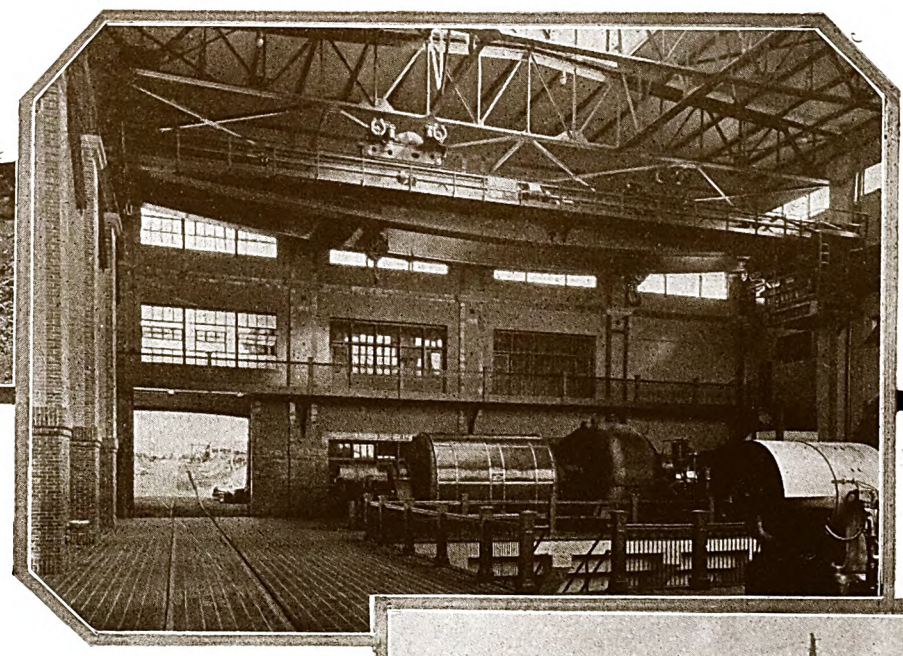
(*Continued on page 54*)



Cranes and electric magnets are now doing the difficult work of handling pig iron and sheet metal scrap. This is only one of the many problems that this equipment can solve. Large sheets, and pipe, can be handled in the same manner.

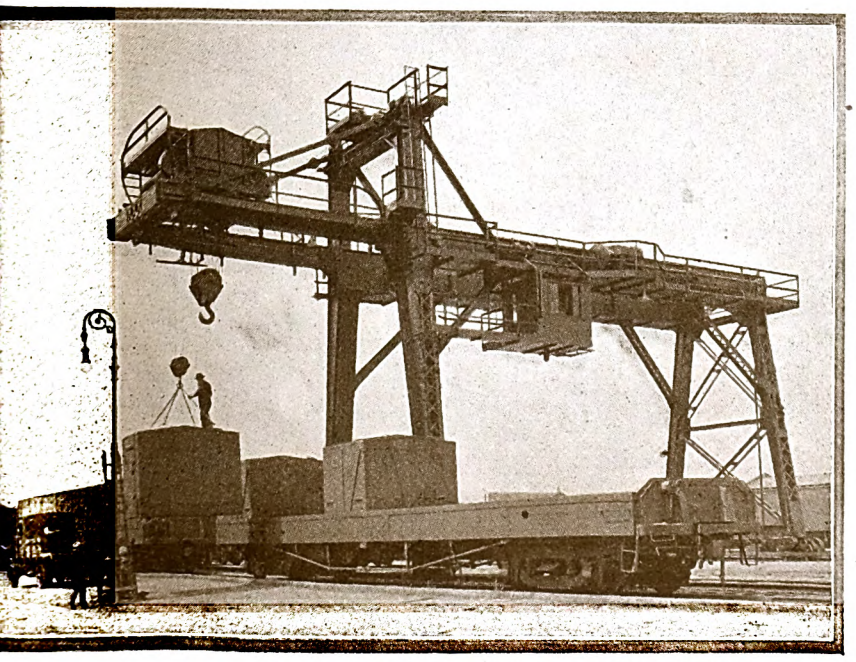


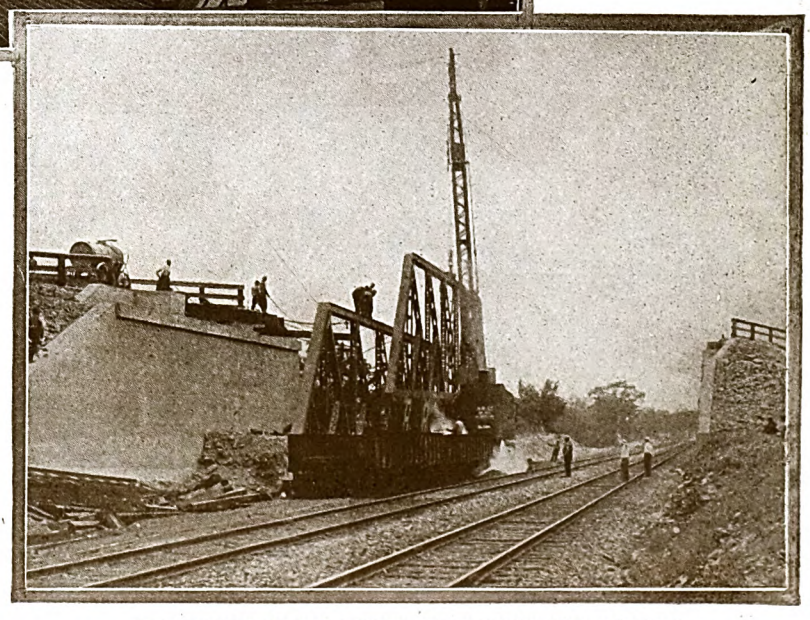
ny attachments to the old der feeds itself, elevates the rges its load; the one man when he wishes the machine ition.



Where large machines have to be placed, an overhead crane is a great time saver. Fifteen years ago most power house cranes were hand-operated and comprised little more than a pair of I-beams on wheels and a large chain block.

This phase of materials handling is the most modern, and one that will show considerable development within the next few years; namely, sectional demountable freight cars and truck bodies as a national transportation medium.





Locomotive beam cranes now make the placing of bridges an easy task. This 25-ton truss is swung in place, already riveted and ready for the cross members. Can you recall how bridges used to be built?

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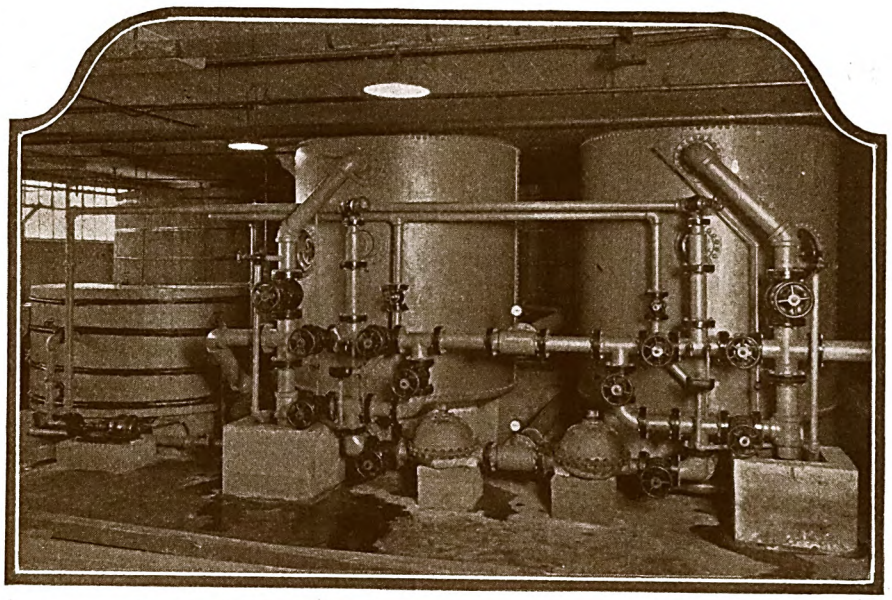
Feed Water Treatment

The Economies Possible Through Proper Equipment

BY JAMES T. BEARD, 2ND

IF your superintendent were to come into your office this afternoon and make the startling announcement that no attempt was being made to check the quality of the raw materials that go into the manufacture of your product, the chances are that he would be immediately subjected to a rigid cross examination in an effort to determine the reason for such a state of affairs. But, if he were to tell you that, although the use of inferior materials was increasing production costs due to waste all along the line, no attempt was being made to raise the quality to the recognized and approved standard, you would probably have a hard time to keep your feet on the floor.

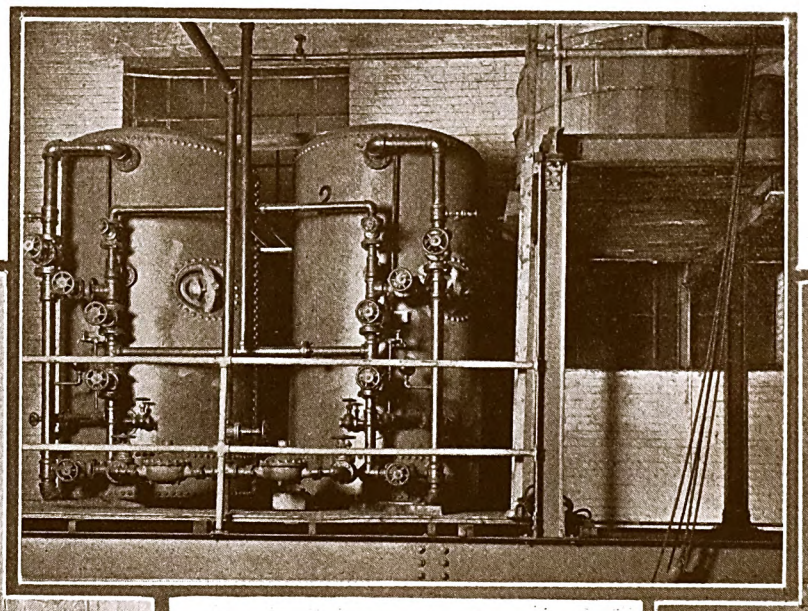
Unless your plant is one of the exceptions to the rule, however, it is quite likely that the lack of definite knowledge of your feed water problem is costing thousands of dollars in terms of increased coal costs, high labor and maintenance costs, uncertain operation, interrupted production and shortened life of your boiler equipment in the power house.



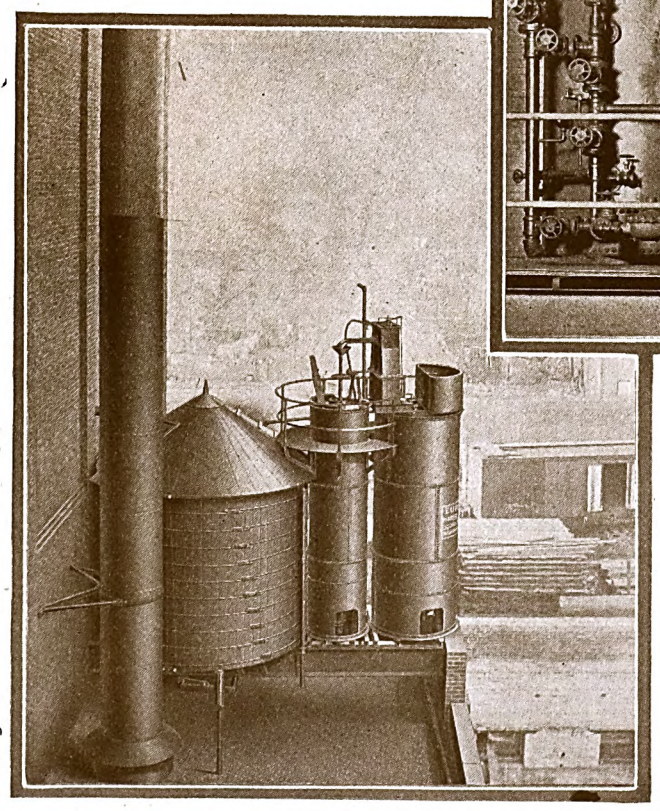
Zeolite double-unit softener in the plant of S. B. & B. W. Fleisher Company, Philadelphia. Each unit can soften 140,000 gallons of 7.3 grain water before regeneration becomes necessary.

I have a picture in my mind of the power plant of a well known manufacturer in New York state. The load is carried on two boilers, of 600 total horsepower, operating continuously for 24 hours a day. Six years ago boiler scale resulting from poor feed water, kept this plant under considerable expense. Each boiler had to be cleaned every four weeks. Thirty tubes were renewed each year. Scale averaged from 1/3 to 1/16 inches in thickness and was responsible for large fuel losses.

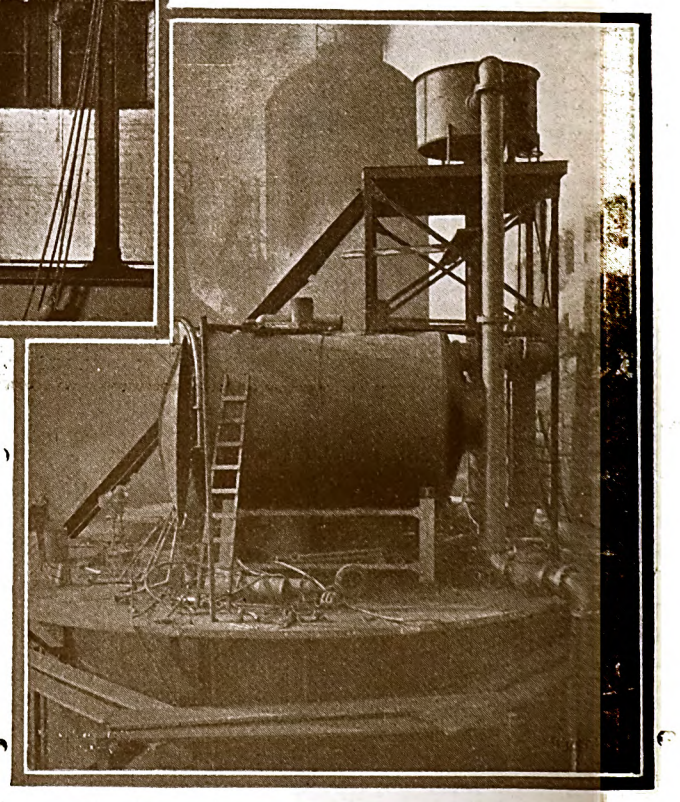
I have another picture in my mind of the same plant today. In the meantime they had made a careful study of their feed water problem and installed a suitable water softening plant. The formation of scale, sludge and mud has been completely stopped. The boilers steam better. Tube replacements have been eliminated. An actual fuel saving of two tons of coal a day has



Zeolite softeners are built in duplicate units for 24-hour plants. One unit is delivering softened water, while the other is "regenerating." This particular outfit is saving money for Supplee-Wills Jones Company, Philadelphia. It has a capacity of 40,000 gallons between "regenerations."

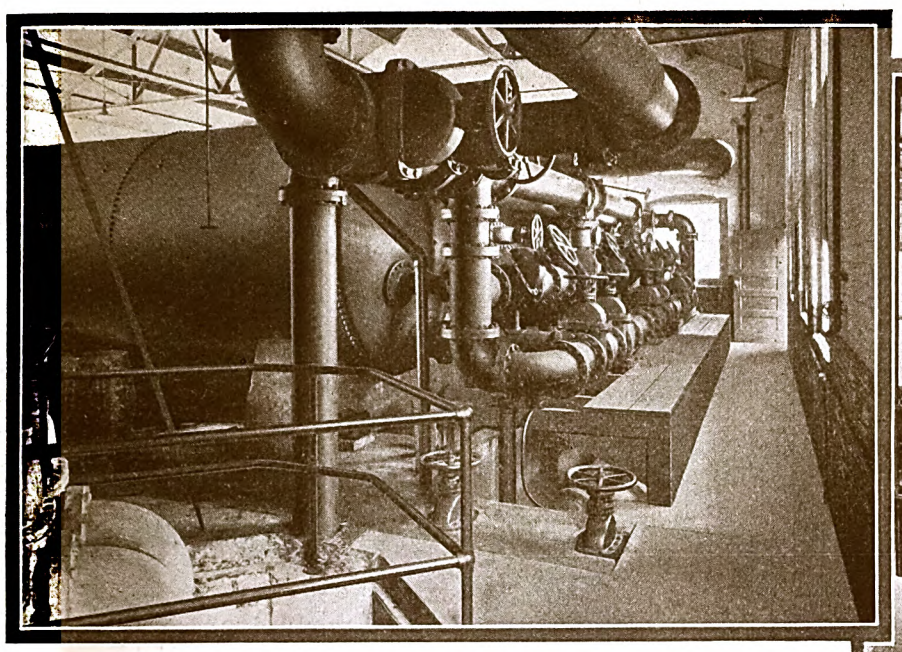


Here is a suggestion for power plants in congested cities where space is at a premium. If proper provision is made in the steelwork and supporting members of the building the bulky tanks may be placed on the roof.

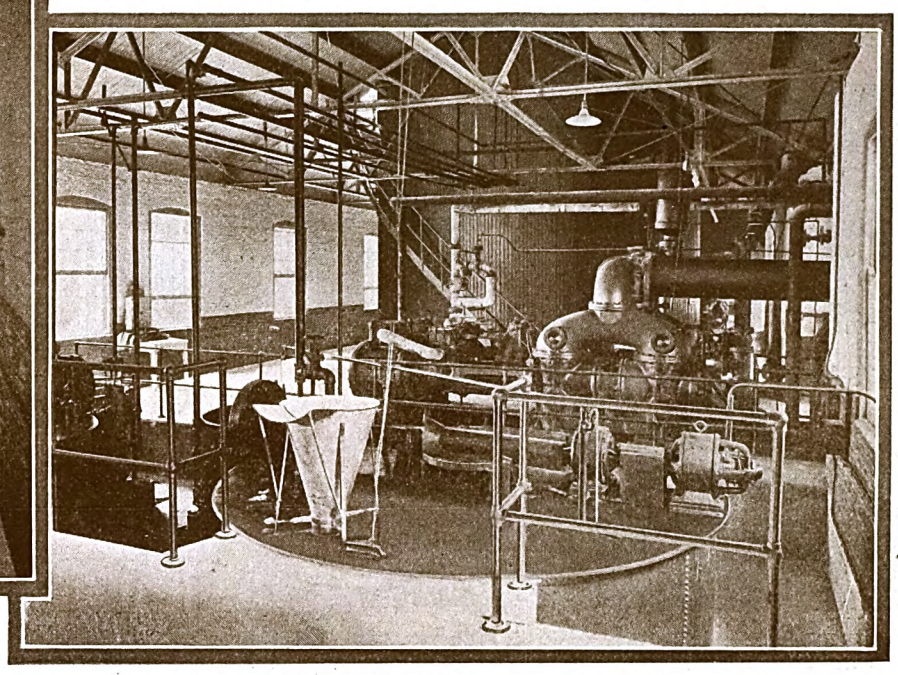


The hot process of lime-soda feed water treatment has many advocates. In this installation at the Wisconsin Steel Company, South Chicago, the water is first passed through an adequate heater, located above the settling tank. The smaller tank in the upper right hand corner is the hard water apportioning tank.

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Six filters are necessary to take out the sediment and precipitated salts that will not settle of their own accord. The picture shows the filter room which is a part of the water purification equipment at the Wisconsin Steel Company's plant.

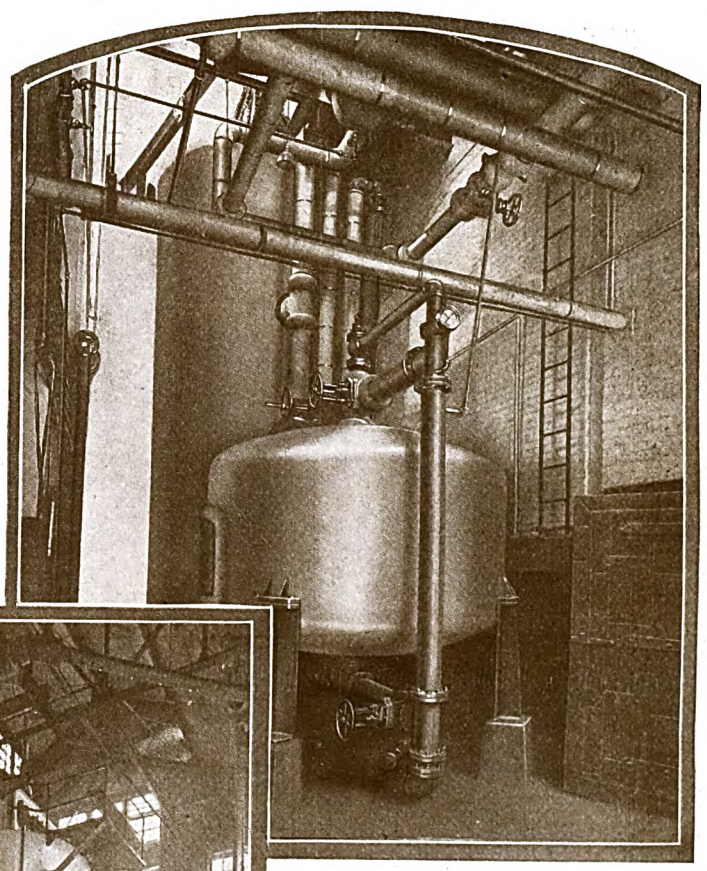


General view of the hot-process lime-soda water softening equipment at the plant of the Wisconsin Steel Company. The chemical and chemical control tanks are seen in the foreground, while the large settling tank is behind them.

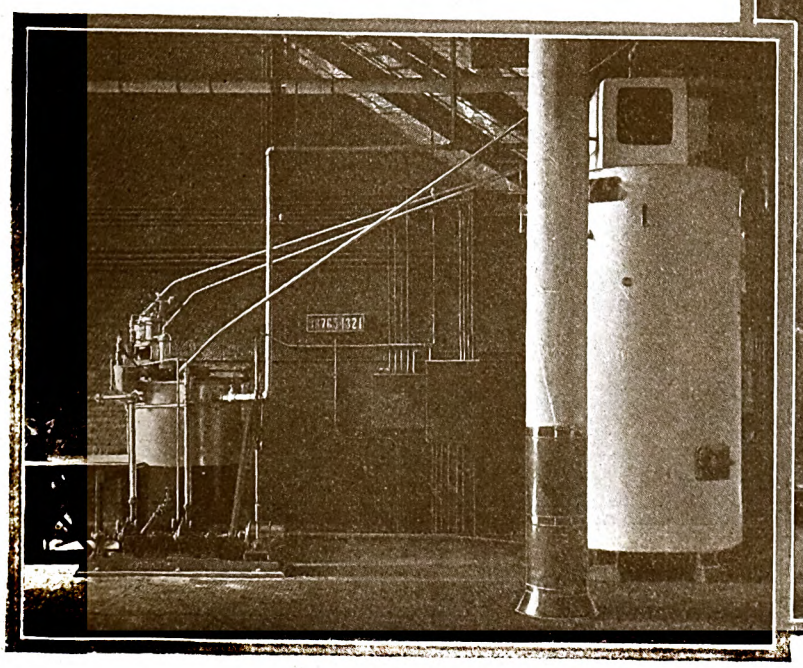
been the direct result of this change.

The feed water in this plant was not what would ordinarily be called bad. Feed water does not have to be bad to cause boiler troubles. Constant evaporation of the water leaves all dissolved impurities in the boiler, until the water becomes so concentrated with salts and sediment, that the heat bakes them into a thin crust on the metal surfaces of the tubes and drums. This heat-resisting layer grows thicker and, as it grows, more coal is required to evaporate the same amount of water than before. When the scale becomes sufficiently thick the heat of the furnace is apt to blister the tubes. At times the metal becomes very hot, and softens and bulges under the pressure in the boiler. In bad cases the metal will fail completely and the tube will burst.

To prevent loss of operating efficiency and to insure the safe operation of the boiler, it is necessary to knock out this scale by mechanical devices, as fast as it accumulates in any appreciable thickness. How fast it will accumulate depends upon how much impurity is in the water. Every time a boiler has to come off the line for cleaning it costs real money, for the heat in the boiler and setting is entirely



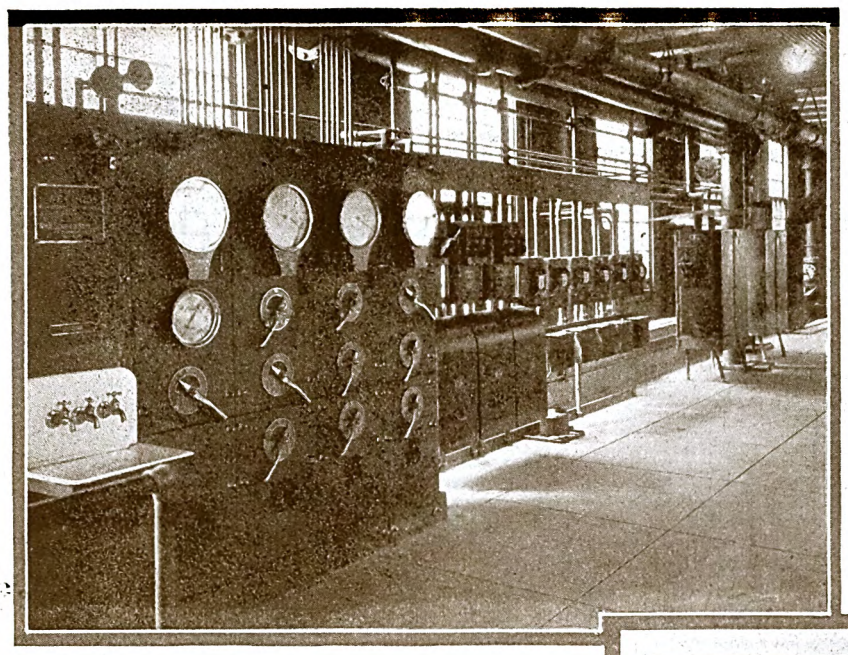
It was considered part of the boiler room routine at the Louisville Street Railway Company's plant to turbine the tubes every six weeks. Then came the water softener and the boilers are now operated for more than a year without cleaning. They operate at 160 to 200 per cent. of rating on Ohio River Water without foaming or priming.



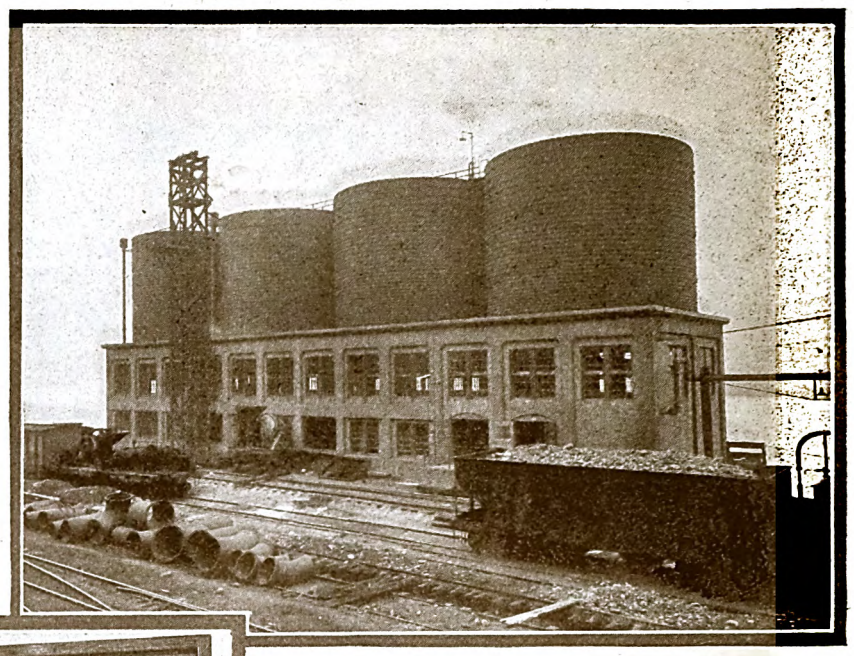
After the Dominion Tire & Rubber Company, Kitchener, Ontario, installed this equipment the boiler inspector reported that their previous trouble with scale and corrosion had been eliminated. This particular installation has a capacity of 10,000 gallons per hour.

Three tube replacements per month as compared with thirty before this softener was installed in the plant of the Halcomb Steel Company, Syracuse, tells a worthwhile story of reduction of maintenance costs. 12,000 gallons of 40 grain water are handled every hour by this softener.

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Feed water purification control reduced to a science. The picture shows sampling and operating board of a feed water purification system which controls positively every detail of the system. Recording gages give full record of the operating cycle of each tank.



Central water purification plant from which several boiler houses are served. The capacity of this installation is 3,000,000 gallons every 24 hours.



Without any previous knowledge of chemistry any chief engineer can manipulate one of these testing cabinets and find out what kind of boiler feed water he has to deal with. It takes the guesswork and experiment out of his feed water treatment and often puts the boiler house on a dividend-paying basis.

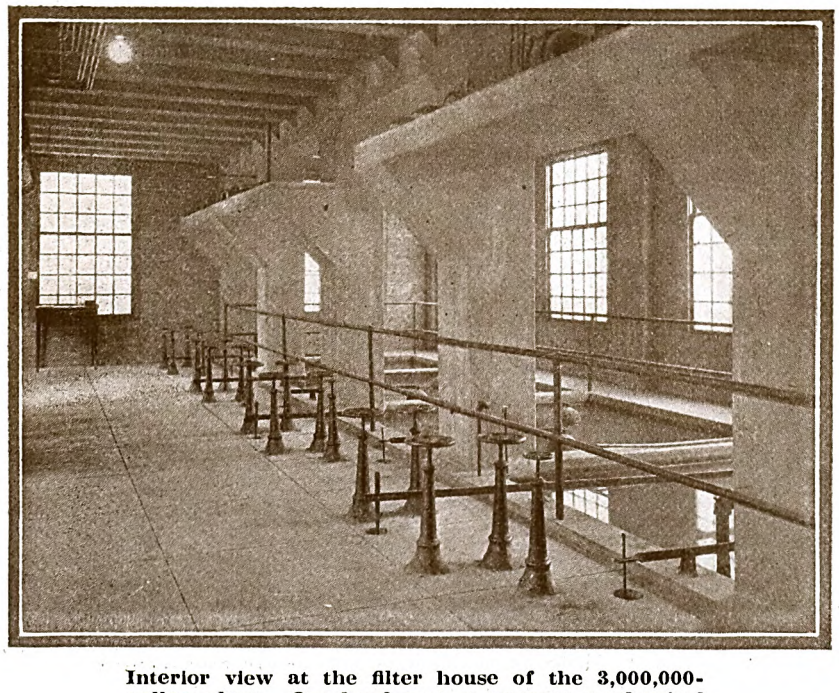
lost, the labor involved is a big item and the weakening of the boiler structure due to the strains of cooling and reheating lessens the life of the equipment.

I have a picture of another plant where the "chief" prides himself on his excellent feed water. Each boiler is cleaned every three months. Boilers are blown down twice daily. And the plant averages two tube renewals a year for each boiler. Water softening is considered unnecessary. The "chief" is right,—the water is undoubtedly good.

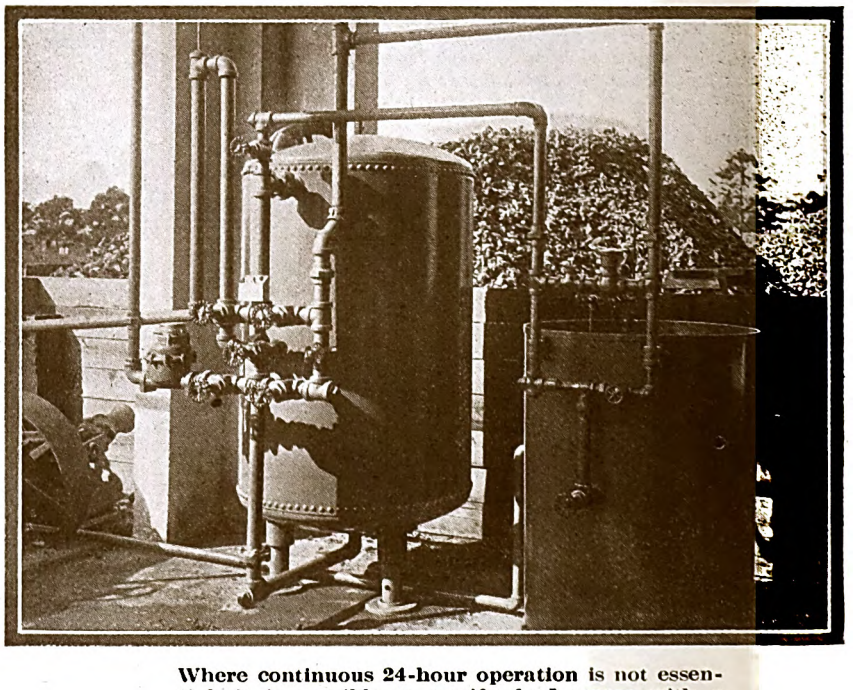
Across the river is another plant, using practically the same water, but treating it in a well designed softening system. In this second plant there has not been a tube renewal nor a boiler cleaned in the past two years.

"Good" water or "bad" water really do not mean anything from a boiler room operating standpoint, unless you can also tell "how good" or "how bad." I once had occasion to ask a certain chief operating engineer why he thought his water was good. He replied that he never had any boiler trouble. Further questioning elicited the information that he cleaned the boilers three times a year and possibly renewed one or two tubes during the same period in each unit. I wonder what he would say about his feed

(Continued on page 28)



Interior view at the filter house of the 3,000,000-gallon plant. Overhead motors operate mechanical stirring devices. Each filter is equipped with individual control valves. Pipe connections, pumping equipment and clear water well are below the floor level.



Where continuous 24-hour operation is not essential, it is possible to purify feed water with a single zeolite unit as shown here, since there is ample time for regeneration during the no-load or light-load material.

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Promoting Team Work Through Athletics

How Studebaker Has Reduced Labor Turnover and Increased Production, by Fostering Sports

By D. G. Baird

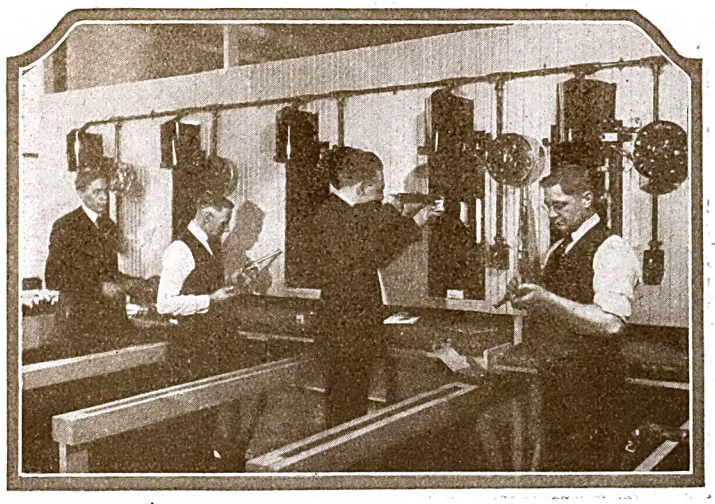
IN the month of May, 1920, an average payroll of 5,601 produced 3,530 automobiles in the Detroit plants of the Studebaker Corporation. In the same month of the following year, an average payroll of 4,650 produced 4,059 automobiles in the same plants. During the corresponding month of 1922, an average payroll of 4,996 turned out a total of 5,722 Studebaker cars.

Comparison of other corresponding months of these years shows similar results. June of 1920, for example, reveals an average payroll of 5,790 and a production of 4,183 cars. During the corresponding month of the following year, an average payroll of 4,695 produced 4,522 cars, and in June, 1922, an average payroll of 5,112 turned out 5,461 automobiles.

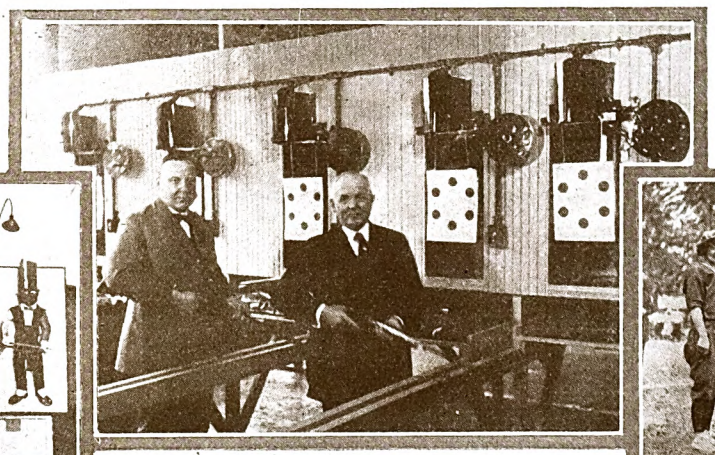
These months are chosen for comparative purposes because it is at this time that automobile production is at the maximum and it is to be expected that labor turnover would, therefore, be at the maximum also.

Now consider this matter of labor turnover during the same months of the same years. In May of 1920, the labor turnover in the Stude-

(*Continued on page 46*)



Target shooting is not only an interesting pastime but it trains the eye. At the Studebaker No. 5 plant there is both a 75-foot and a 25-foot range.



In the above picture Mr. Max Wollering, vice president of the company, and Mr. C. L. Bockus, in charge of production are initiating a new range.



This very attractive display was used to advertise the big yearly event given to replenish the employees' charity fund.



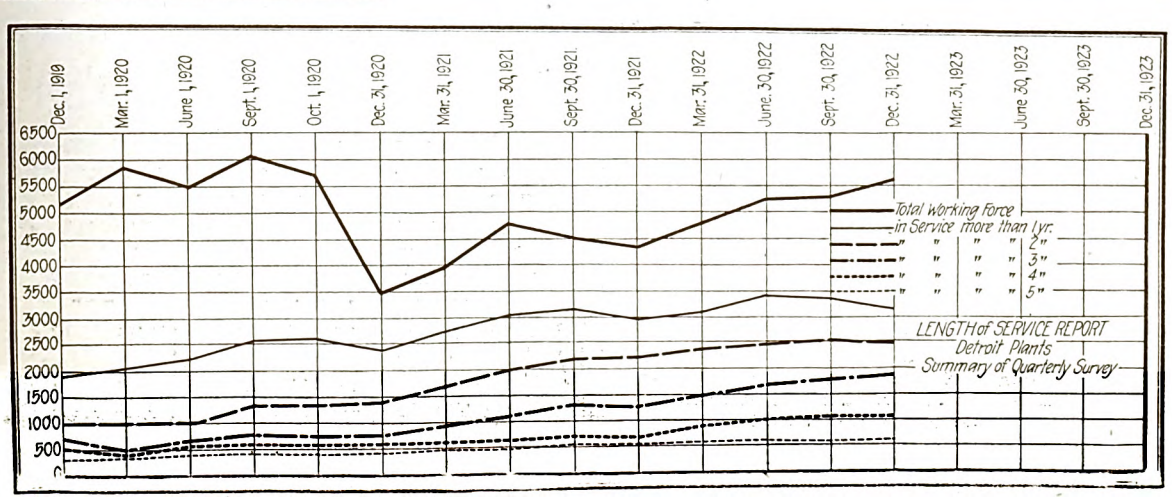
The ladies have their part in Studebaker athletic activities. Here is the winning team of plant No. 5, with its manager and mascot.



"Three strikes and out" is the title of this picture.



An exciting moment during the Tug-of-War in which plant No. 3 won the event and the silver cup.



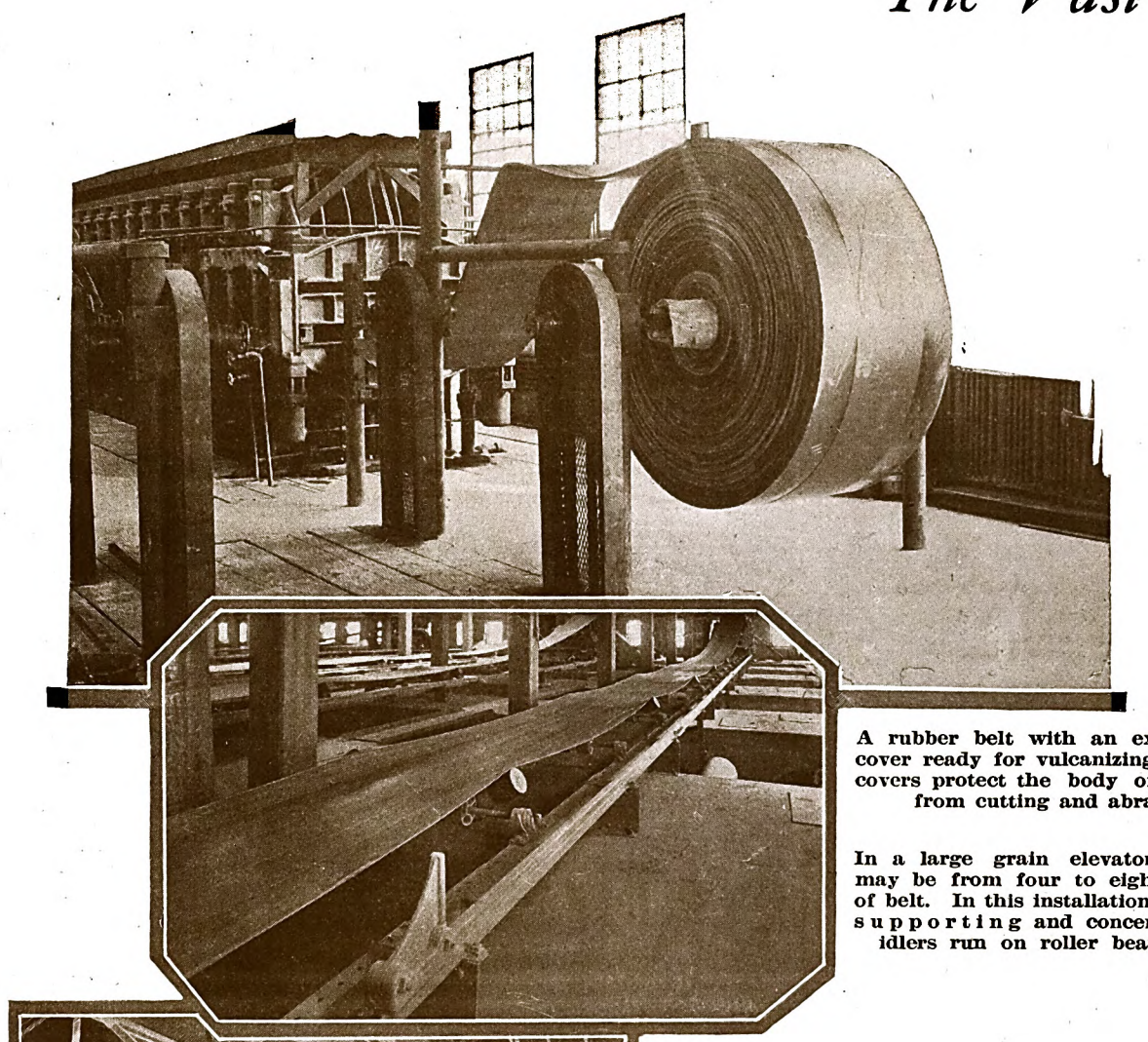
Here is an interesting chart that shows a rather unusual employment record and how the turnover has been reduced by making life interesting for the workers.

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The Future of

The Vast Progress of the Last

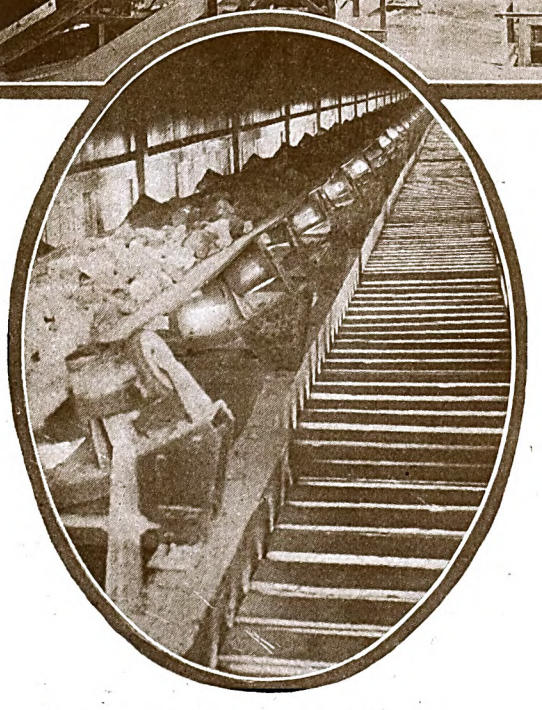
BY FREDER



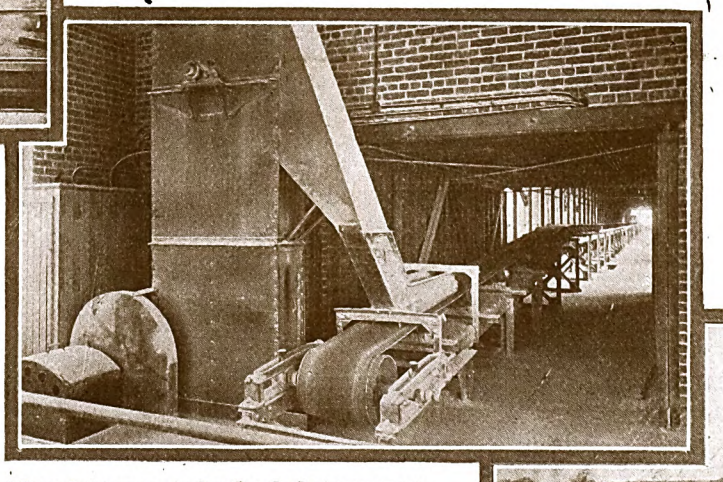
A rubber belt with an extra heavy cover ready for vulcanizing. Rubber covers protect the body of the belt from cutting and abrasion.

In a large grain elevator there may be from four to eight miles of belt. In this installation all the supporting and concentrating idlers run on roller bearings.

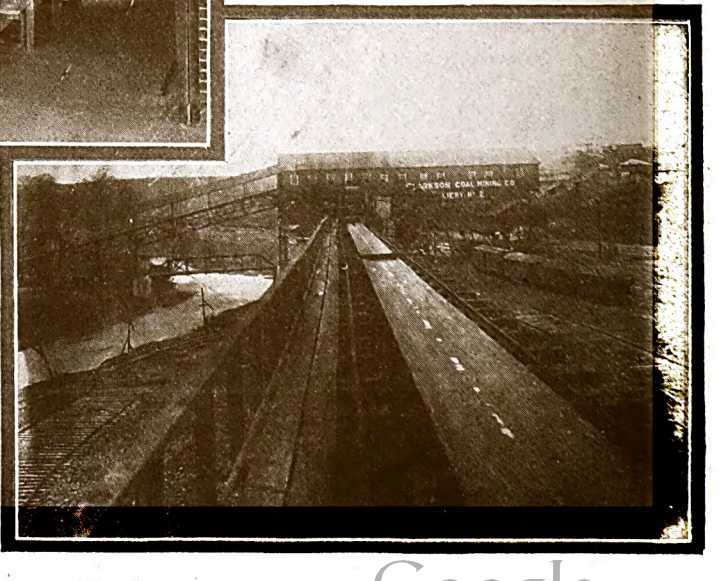
A canvas belt running through a series of fixed trippers and carrying crushed ore. A severe service on account of many reverse bends and the repeated reloading of material back on the belt at the transfer points.



A heavy stone conveyor with belt supported on sheet-steel pulleys fitted with ball bearings.



The right way to load a belt conveyor: the chute delivers material to the belt with some velocity in the direction of travel.



A modern tripper which carries side-delivery belts to distribute material along each side of the conveyor and thus increase the amount of material stored by the main belt.

WHEN we speak of the future of belt conveying, there are several phases of the subject to be considered.

1. It is probable that new uses will be found for belt conveyors, new either as to materials handled, or as new combinations of machines to collect, convey or distribute materials in better ways.

2. With the increasing demand for labor-saving machinery and the concentration of production in large establishments, there will come not only a greater need for belt conveyors, but for belt conveyors of greater carrying capacity and greater length.

3. Knowing what has been done in the past in the improvement of the means for handling materials, we may, in imagination, project forward the line of improvement and think what the ingenuity of men may develop in better belts, and better accessories for supporting, loading and discharging the belts.

These three phases are closely related: ever since the first use of belt conveyors, improvements in conveyor design have gone hand-in-hand with the greater use of conveying machinery, and as new uses and heavier duties were imposed on belts, belt makers have responded to the demand with better, stronger and longer-lived belts.

In the first belt conveyors

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Belt Conveying

Few Years, and What It Presages

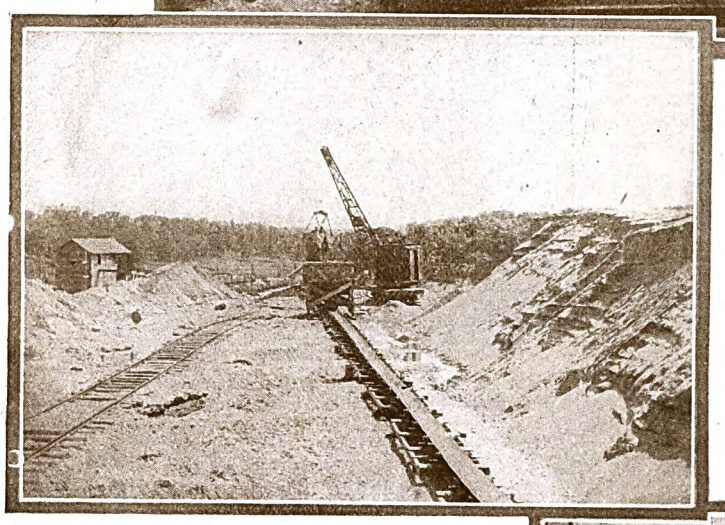
ICK V. HETZEL

used in this country, over a hundred years ago, the belts were a single ply of sail canvas, not waterproofed, or were of leather cut from the tanned hide, but not filled and stretched as leather belts should be. These old line belts ran crooked, they changed their length according to the weather, and were generally so troublesome that they did not come into extensive use. There were mills and factories here and in England where belt conveyors could have been used, but screw conveyors were preferred, even though they took more power to run.

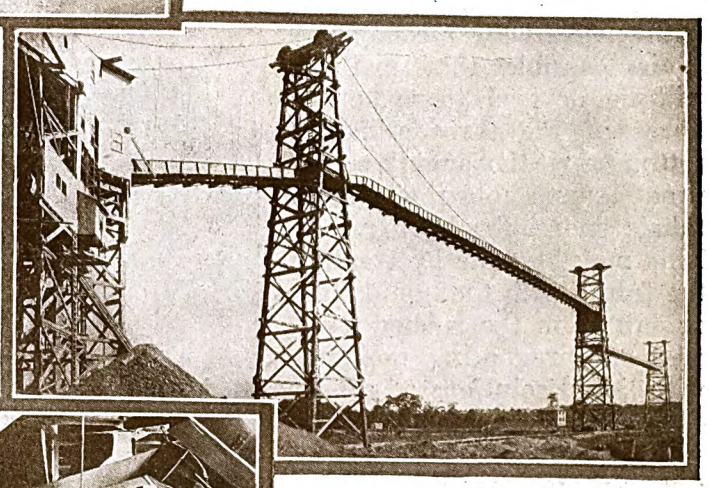
The first rubber belts for conveyors were made for experiment in England about 1860, after 1870 they came into practical use in this country. About the same time, impregnated and pre-stretched canvas belts were introduced. These various improved belts were used at first to carry grain and flour-mill products.

Rubber belts with thickened rubber covers came into use after 1893. As they could carry rough, heavy and abrasive materials without serious injury, they immediately extended the use of belt conveyors to such materials as coal, ores and minerals which prior to that time were not handled well in conveyors of other types nor carried economically by rubber belts which lacked the reinforcement of the rubber cover. Rubber belts as now

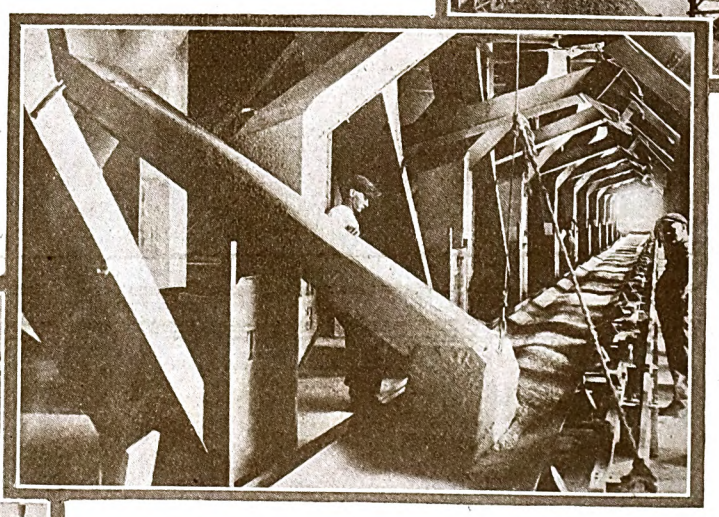




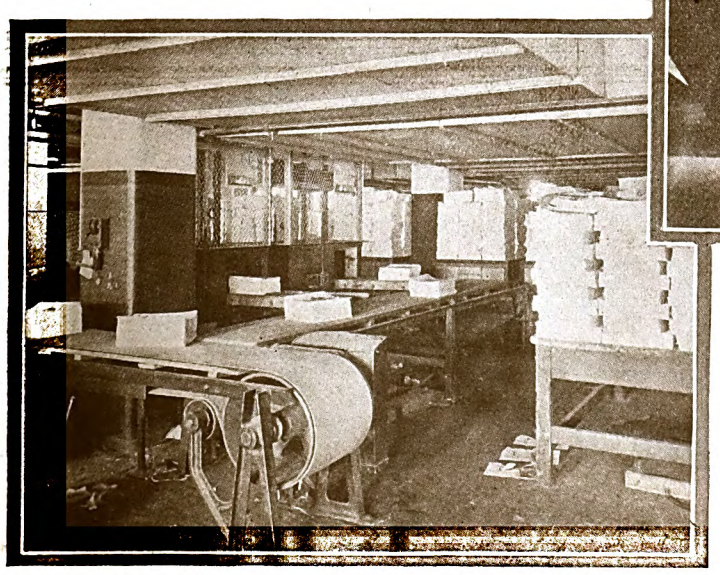
The sand and gravel business could not exist without the belt conveyor. One inclined belt delivers to the washing. The other delivers to a shuttle conveyor on the elevated trestle, and this by moving to and fro forms a pile the crest of which is twice as long as the shuttle.



A belt conveyor carried on portable frames brings the excavated material to a central car-loading station. Shifting the conveyor is more convenient than shifting the siding.

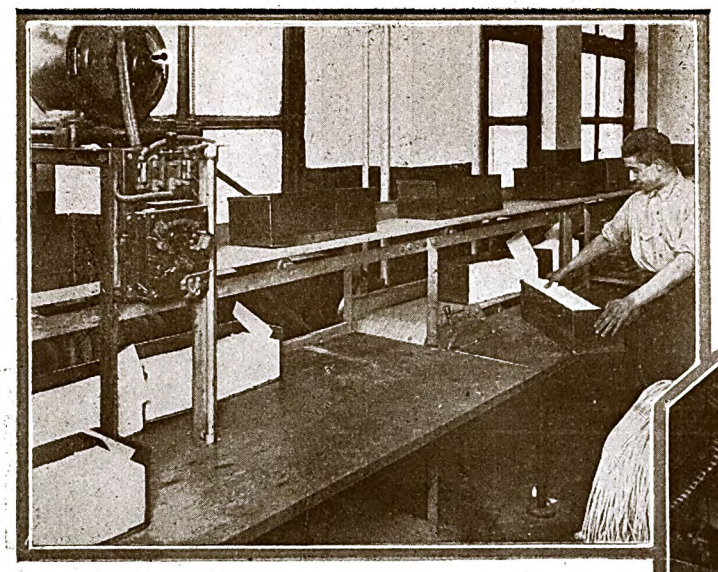


In this grain elevator there are 25,000 shaft bearings fitted with anti-friction rollers. After 4½ years of service, the bearings in this conveyor show practically no wear although they have made over 300,000,000 revolutions.



Belt conveyors in a publishing house carry magazines from automatic discharge elevators to wrapping counters. Two right-angle transfers between moving belts without disarranging or upsetting the piles of magazines.

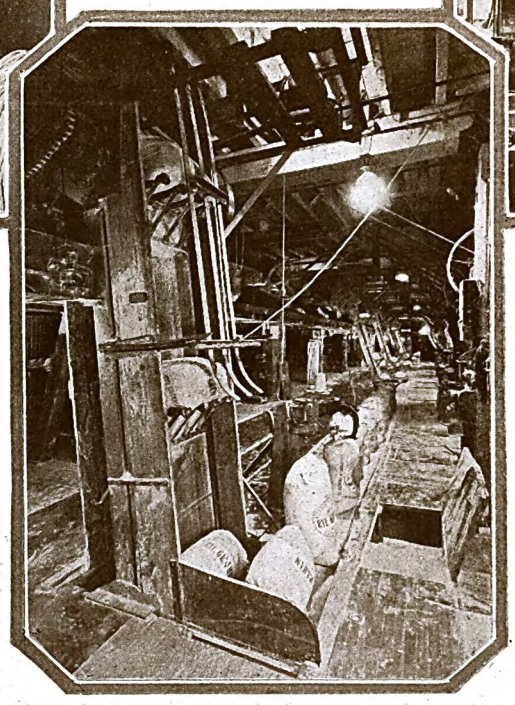
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A double deck belt conveyor in a book bindery carries loaded containers in one direction on the lower run and returns empty containers in the opposite direction on the upper run.



A belt conveyor serves a long line of machines, increases output and reduces costs.



Sewing shut the mouths of flour bags while in transit on a belt conveyor.

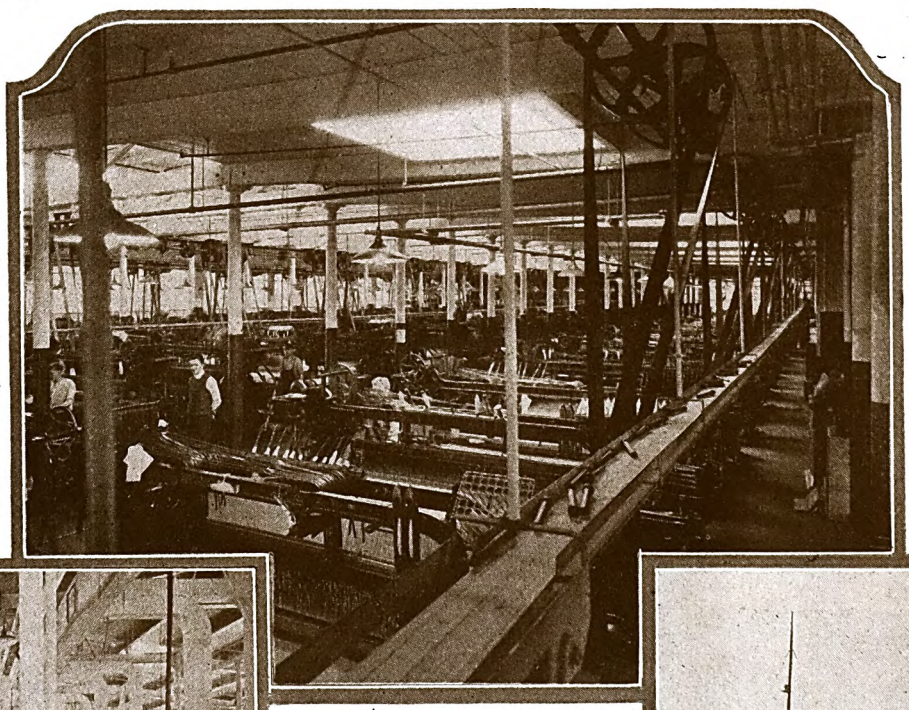
made by experienced manufacturers are the development of the past fifty years, but there is no reason to think that progress has stopped. Conveyor belts are, in general, better than they were, especially in this line of heavy belts for hard work, and we may hope and believe that the rubber belts of the future will be still better. In belts built up of a number of plies of woven cotton duck cemented together by a rubber compound, it is possible that methods will be devised to make the fibres of the threads in the cotton fabric thoroughly waterproof and to hold the plies of fabric more firmly together. This may be done by treating the fabric with the liquid latex or sap from the rubber trees, or by impregnating the duck with liquid solutions of rubber compounds, and then vulcanizing the assembled plies of waterproofed fabric with a finished belt.

Some belts have been made in which the lengthwise structure of the body is made up of many parallel cords, larger and stronger than the threads which compose the warp of the duck in belts as ordinarily made. The work in this direction is, for the present, experimental and introductory, but the possibilities are interesting. Such belts are likely to be stronger than fabric belts, and hence well suited to conveyors of great length and heavy loading. If they can be sold at prices to compete with standard rubber belts, the developments in this direction are not likely to be slow or delayed.

In recent years canvas belts and balata belts have been greatly improved and are coming into extensive use. For strength, resistance or moisture and freedom from stretch, they compare favorably with good rubber belts.

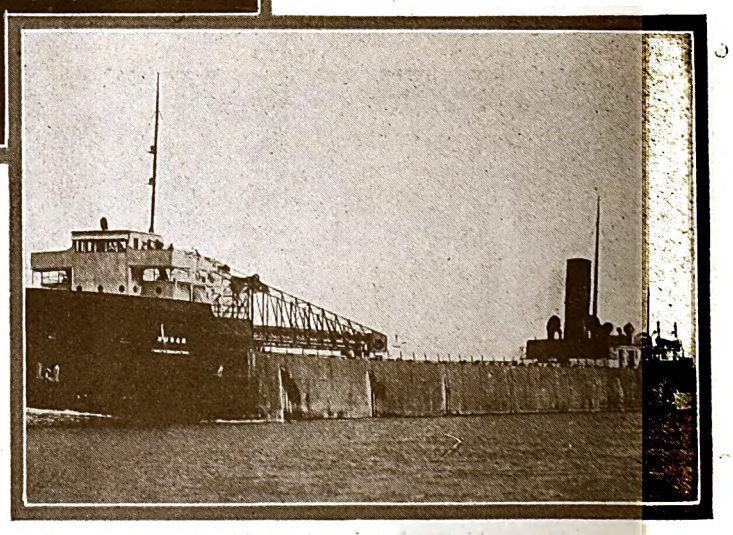
In the means of supporting the belt, there has been improvement, but it has come slowly. The grease-lubricated,

Below—conveyors in a large textile mill.



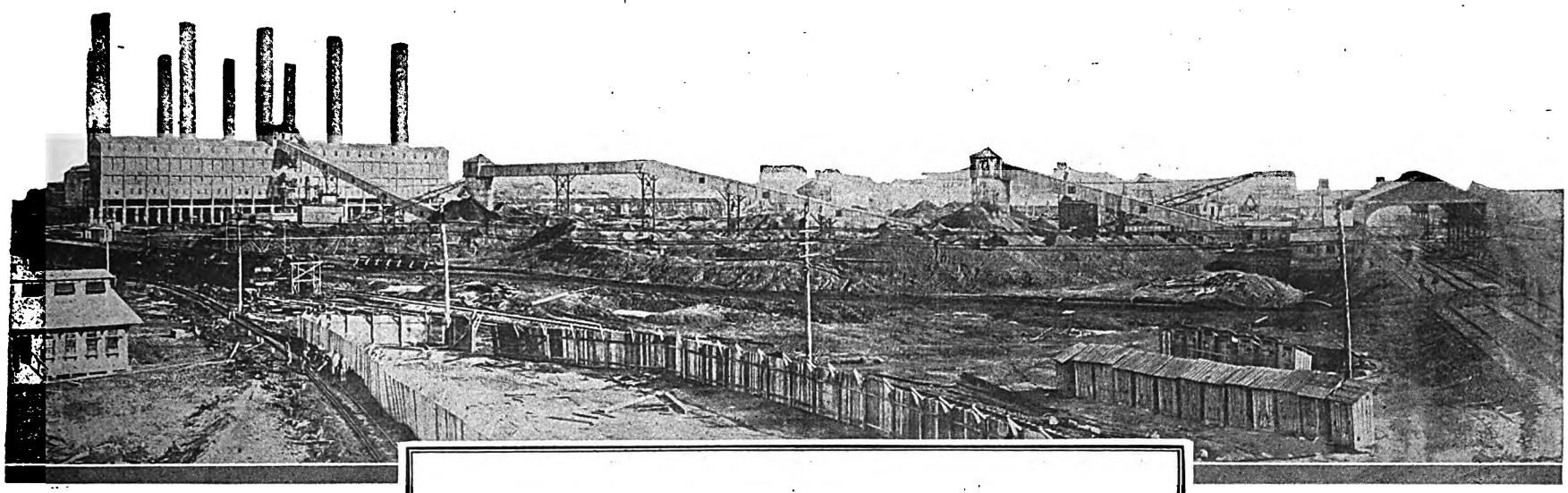


A belt conveyor with oilless bearings carries washer goods on one deck without wearing or soiling, carries wrapped goods on lower deck.



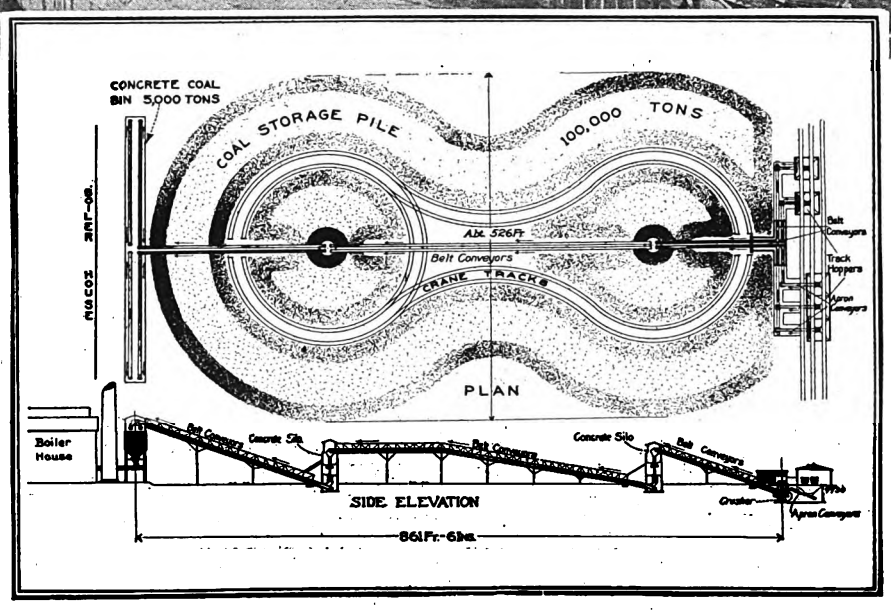
A Lake steamer fitted with wide belt conveyors for discharging its cargo of crushed stone.

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multiple-pulley idler in general use at the present day is about what it was thirty years ago. Lubrication by grease is convenient in dusty, dirty places but under many operating conditions, it is neither certain nor efficient. Looked at from the standpoint of power consumed in turning the idler pulleys, the coefficient of friction with grease lubrication is not low: and considered from the standpoint of maintenance, neglected, the idlers wear out, there is an added and unnecessary strain on the belt, and the belt is apt to be scraped or damaged on idler pulleys that stick tight and then refuse to turn. Good belts will withstand a great amount of abuse, but it is expensive to permit it. There is no doubt that in many plants the high cost of belt maintenance is due to faults in idler construction and in the neglect of lubrication.

In order to prevent coal, ores and minerals from cutting and wearing the surface of the conveying belt it is necessary to load it in such a way that the material is delivered to it with some velocity in the direction of travel. It is possible to make a conveyor belt act as its own feeder, but with such material it is not profitable. This may seem like a trite remark, but it is a fact that some belts are still fed from side-delivery chutes, or are expected to take sudden rushes of heavy material, or are so placed that the material falls vertically onto them. It is well known that all of these arrangements are defective and that they serve to injure the belt.

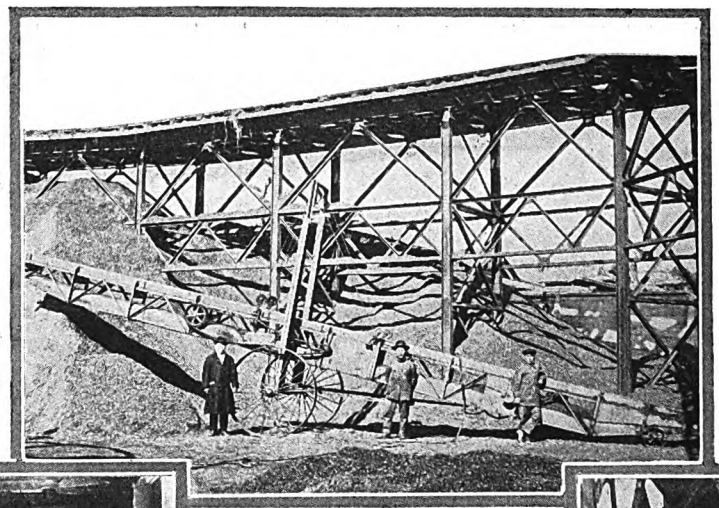


By combining belt conveyors with locomotive cranes, it is possible to store immense quantities of material and reclaim practically all of it at a rapid rate without expense for hand labor.

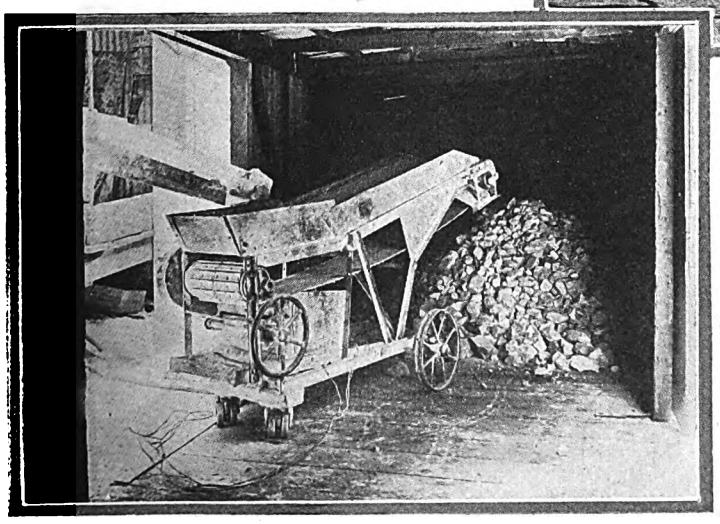
Feeders of various kinds are coming into more general use and in the future still more attention will be paid to the design of loading chutes. Screen chutes and chutes with stopped ends should be used oftener to handle run-of-mine coal and similar mixtures of lumps and fines. They permit the fines to reach the belt first and protect it from the sharp corners of the heavy pieces; the extra cost of the chute is more than saved in the longer life of the belt.

The tripper with its two pulleys bending the belt into an S form is no doubt the best means to effect a discharge

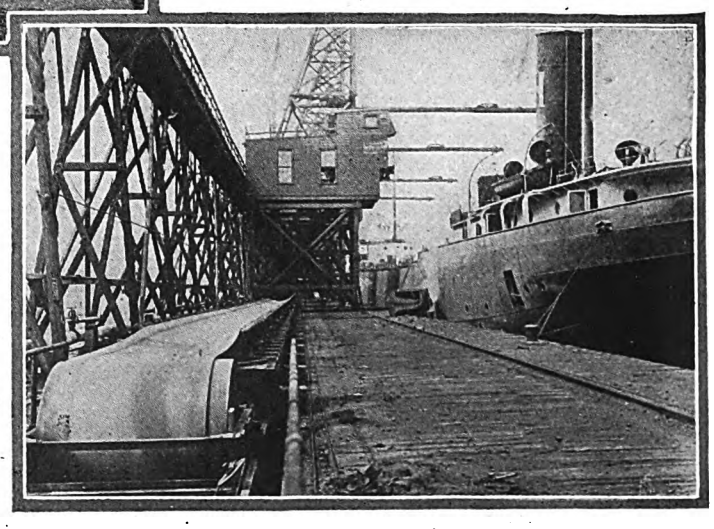
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Even in Japan, with its low priced labor, it is found economical to store and reclaim coal by means of a portable belt conveyor.



A high speed self-contained belt conveyor used as a throwing machine to load box-cars.



A 54-inch 11 ply rubber belt 1,500 feet long handling run-of-mine coal. Has carried nearly 3 million tons in 6 years. Only partly protected from the weather.

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The Deserted Power House

The Sub-Station That Does Its Own Thinking

By Oliver S. Arata

YOU all have passed a deserted house and wondered what was in it. You all have thought of the possible spooks or ghosts that possibly roamed the floors, unmolested, of that particular, weird place. Did you ever pass a very modern structure, that did the work of a power house, and see it constantly closed?

Most likely you did not. Well, in St. Louis, Mo., the United Railways Company, which owns all the street railways of St. Louis, and is a very large corporation, has constructed some brick houses, one story in height, and when the five houses are completed the doors will be locked, and they will be apparently idle.

But the rotary converters, transformers, etc., used to furnish the power when needed, will not be idle at all times, for when needed for more power they are called in play by ingenious devices, described herein.

The automatic sub-station can adjust itself from the lightest load to the heaviest load required at the height of the traffic.



As the "deserted power house" looks, to the casual passer-by. Exterior of 300 kw. automatic sub-station on the St. Charles line, St. Louis.

When a load comes upon the station the automatic relays begin to function, and all in harmony.

One of the converters, at the slightest call, begins to operate, and changes a 440-volt alternating current to a 600-volt direct current, as is used in trolley wires. It is a perfect magician, for as the visitor stands there watching the boards, things begin to move as they possibly do in that haunted house you passed at dusk, or night.

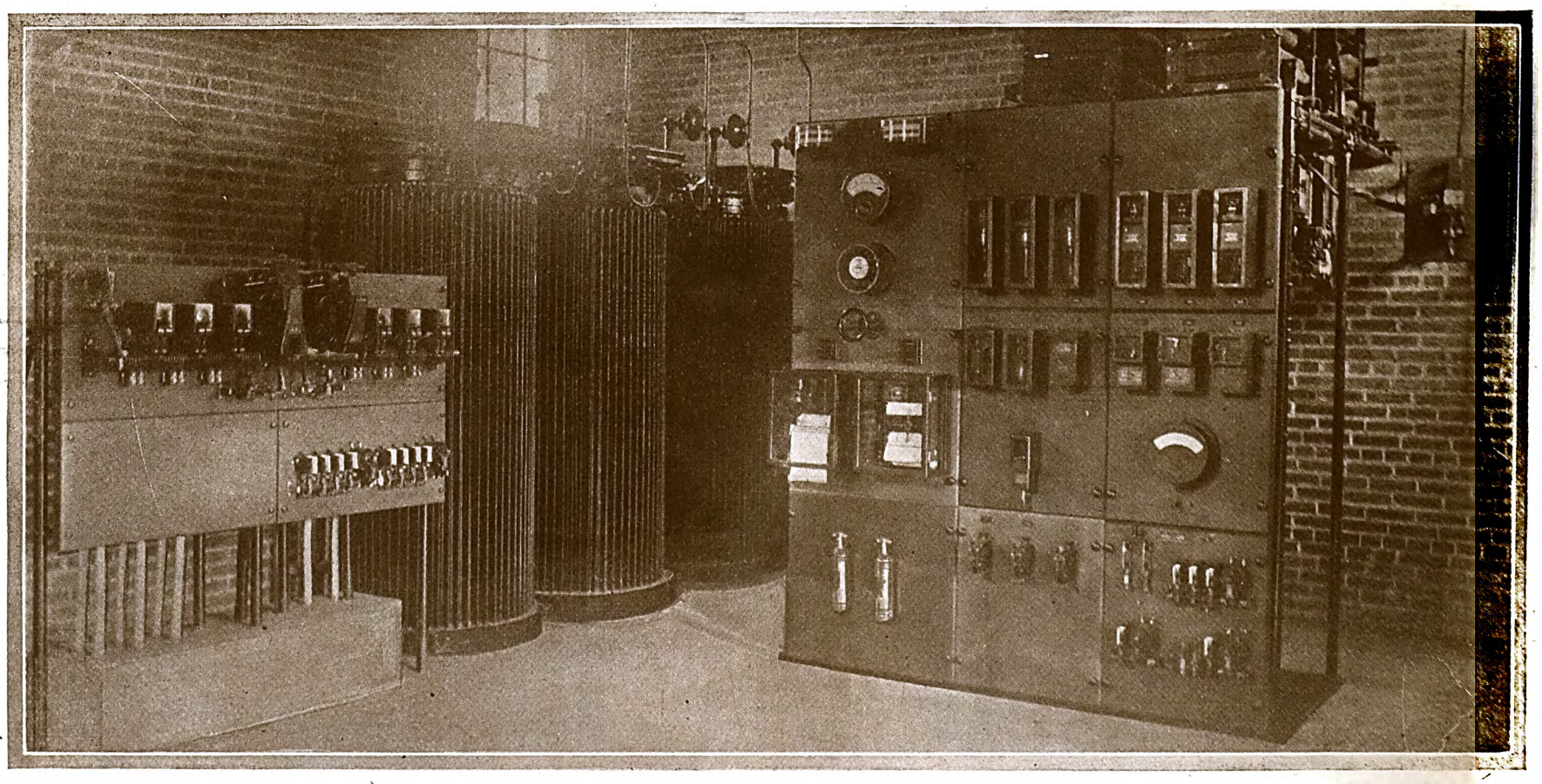
If you want to understand the working of a station you must know that as the load increases in the vicinity of a station, temporarily not in operation, the voltage drops. When the voltage drops to a predetermined point a relay then closes. This step brings the station into service.

When the relay closes other automatic devices do the work required by attendants, for one closes the high-voltage "oil-switch." The "oil-switch" supplies current to the rotary converter. Other devices protect during the starting period.

The "cutting-in" when the machine is ready to be placed on the trolley circuit is done by the use of so-called "load-limiting resistances," which limit the load to a safe figure.

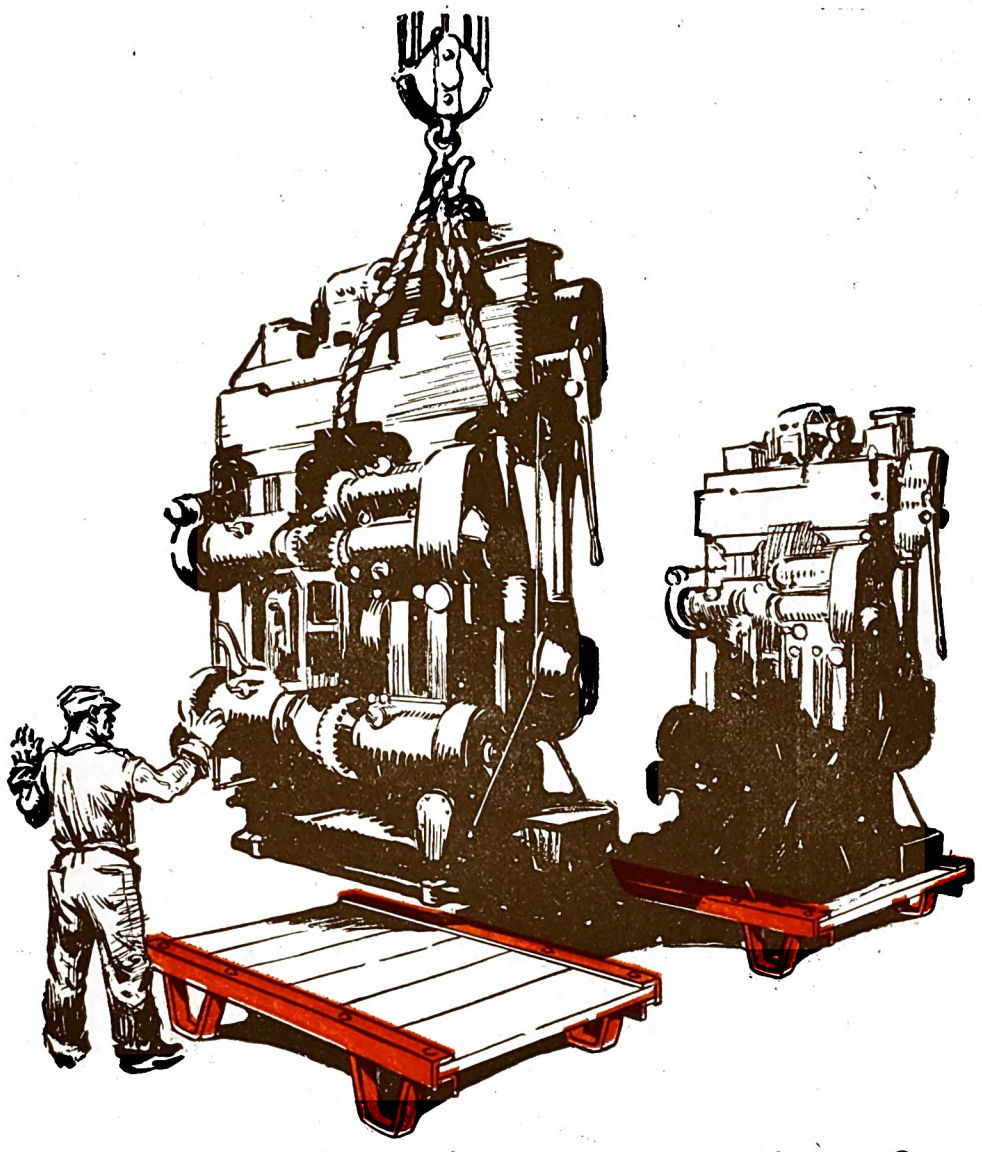
When the sub-station is no longer required it is temporarily cut out automatically, by use of other relays. A surbur-

(*Continued on page 56*)

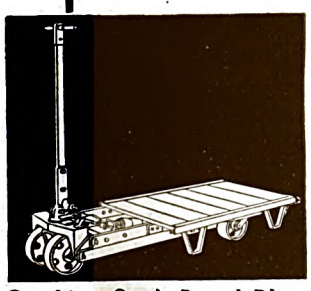


Interior of the automatic sub-station; showing the three power transformers, switchboards, and automatic relays.

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Here's a platform powerful as the lift truck itself



Stuebing Steel-Bound Platforms match the Stuebing Lift Truck in strength of build and adaptability of service. They won't wear down or wabble

Your shop foreman will tell you that under average trucking duty the ordinary platform with nailed wooden legs has to go to the repair shop about every five weeks. A year's continuous service and it is ready for the junk pile.

Follow the example of hundreds of alert factories and terminals. Standardize on Stuebing "Steel-Bound" Platforms and save upkeep expense. Keep *all* of the money that your lift truck system is saving you.

Stuebing Platforms are built especially to stand the same severe loading and hauling duty the Stuebing Lift Truck has mastered. Powerful steel rails protect edges and corners of the oak top. Forged steel bolts clamp rails, top and steel legs together in a vise-like grip, binding the whole into a rigid, non-wabbling unit. Hence—"Steel-Bound!"

Stuebing Platforms can be used to full advantage with any make of lift truck—either hand or power-propelled. They come in various sizes, with carrying capacities up to 10 tons. They are easily fitted with stakes, bins or racks to handle any product.

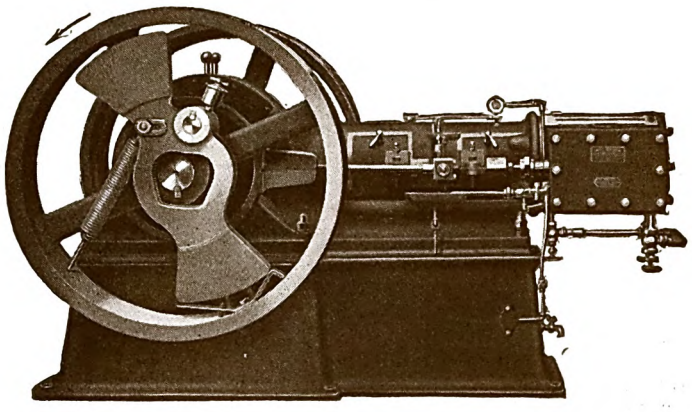
Stuebing "Steel-Bound" Platforms actually cost less than old-style nailed platforms, because they give unlimited service, and pay for themselves in the upkeep savings effected. Find out more about Stuebing Platforms. Write today for descriptive folder!

The Stuebing Truck Company, Cincinnati, Ohio; Montreal, Que.

StueBing

LIFT TRUCK SYSTEMS

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The Big Features of a Small Engine

Many of the features of the small sturdy Troy Engines loom large when comparisons are made.

There's the self-oiling system which automatically supplies an abundance of oil to all bearings. The flow of oil keeps bearings clean and reduces wear to the minimum.

Then the Balanced Valve—an exclusive Troy Feature. This remains steam tight for years. The valve is balanced, except for sufficient pressure to hold its seat, yet operates freely and will relieve the cylinder of condensation—making the Troy the safest small engine.

These and other exclusive Troy features are reasons for the decision of prominent stoker manufacturers for standardizing on Troy Engines for stoker operation.

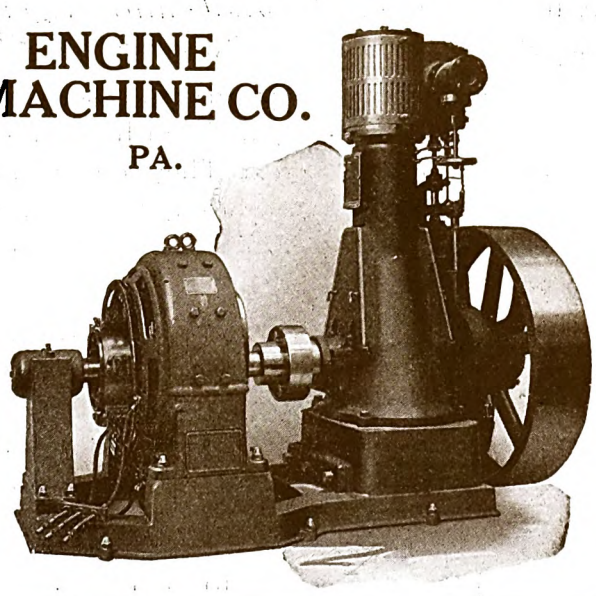
For fans and blowers, for exhausters in gas plants and as auxiliaries to larger prime movers Troy Engines are the logical choice because they are economical in operation, require the minimum of attention and run for years without breakdown.

All well worth remembering when a small engine is required.

TROY ENGINE & MACHINE CO.

TROY, PA.

Write for the TROY Catalog



TROY ENGINES

ONLY STEAM ENGINES GOOD ENGINES ONLY

Feed Water Treatment

(*Continued from page 20*)

water if he could see a certain pumping station out in Ohio where softened water is used and where the boilers have not been cleaned since 1915.

Pure water does not exist in Nature, since it will dissolve nearly everything with which it comes in contact. Heat and evaporation in the boiler leave these dissolved impurities behind in the shell. Since the large majority of all boiler troubles are directly traceable to the presence of these impurities, the careful consideration of the best and most economical methods of rendering water fit for boiler feed purposes is warranted in nearly every instance.

Broadly speaking, there are two methods of softening boiler feed water. It may be treated after it has been fed into the boilers, or it may be softened in specially designed tanks before feeding.

Many compounds are on the market for use in softening water within the boiler itself. Some act chemically, to precipitate the soluble salts; others act mechanically, to loosen scale from the boiler surfaces after it has already formed. In either case the resultant sludge settles to the mud drum and is blown out of the boiler at periodic intervals.

The use of boiler compounds has the advantage of low first cost and simplicity of operation. Blowoff losses are considerable, however, and it is not always possible to correctly gauge the amount of compound necessary to properly treat the water. In many plants, however, the first cost of a more elaborate system would make it prohibitive. In such cases, properly selected boiler compounds, intelligently used, materially reduce boiler operating troubles, thereby reducing production costs to a corresponding degree.

Certain salts are found to be soluble in cold water, but insoluble in hot water. When these are present in boiler feed, it is said to be temporarily hard. Such water may be treated before it enters the boiler by passing it through an open feed water heater, which is provided with a settling tank of ample capacity to allow the precipitated salts to settle.

Permanently hard water, however, is not affected by heat treatment and must be softened by the use of chemical principles. One method is to precipitate the salts by suitable reagents, usually lime and soda. Large settling tanks and suitable filters are provided with this system. Considerable time must be allowed for settling, and some installations are provided with two tanks, one delivering softened water, while the other is treating the raw water. Another type consists of a single basin of sufficient capacity to allow ample time for settling as the water flows slowly from the inlet to the outlet. This type is often equipped with heaters, the hot water permitting quicker action and smaller tanks. Such operation is continuous.

Where the percentage of impurities is variable over a wide range, the intermittent type of softener offers ample opportunity for determining the proper proportions of chemicals to be added, since the taking of accurate samples of water for analysis is readily possible.

Zeolite softeners operate on an entirely different principle and remove the hardness from the water by allowing it to percolate through a bed of zeolite material. In this process the zeolite exchanges its sodium base for the calcium and magnesium bases of the salts in the water. A meter indicates when the flow of water has reached the capacity of the tank, indicating that the zeolite has become saturated. The material must then be regenerated by reversing the process and passing a salt solution through the zeolite tank, replacing the acquired calcium and magnesium bases in the zeolite with the sodium base in the salt. In 24-hour plants, one zeolite tank is regenerated while a second tank is softening and delivering water.

Too much stress cannot be laid upon the importance of accurate first-hand knowledge

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of feed water impurities, if any treatment at all is going to be successful. Perhaps a condition exists that calls for treatment by a combination of two or more of the systems described, or perhaps a single simple method will do the work. These are good things to know before the money is spent.

It is well to bear in mind, however, that the mere fact that you have installed the "finest water softening plant in the country," will not automatically reduce your production costs nor eliminate your boiler troubles. Equipment may be 100 per cent. perfect in itself, but its efficient operation depends solely and entirely upon the men who operate it. It would be folly to put an elaborate outfit in a place where it will have unfair treatment or unintelligent and half-hearted supervision. The human element will determine whether your softener is a water softener or a "white elephant."

The writer has in mind a 2,000 horsepower plant in New Jersey, where there was installed a "beautiful" water softening outfit. In spite of this fact, scale and boiler troubles were unusually bad, sometimes accumulating to a depth of ½ inch in two weeks. It was not unusual to have two boilers off the line at the same time for cleaning purposes, thereby reducing the capacity of the boiler house to 60 per cent. of its normal value. Additional capacity was needed and a new boiler had been ordered.

At about this time the writer was called in to give an opinion and to prescribe a remedy, if he could. At his suggestion, samples of the feed water were taken at the source of supply, at the point where the water entered the softener, at the discharge and at the point where it entered the boilers. Analysis of these samples showed that the water was very bad at the source and at the softener inlet. The water coming out of the softener, however, was very good, but the water entering the boilers was very bad again. There was only one answer to the problem,—raw, untreated water was entering the system at a point between the softener outlet and the check valve at the boiler. The possibility of a by-pass in the feed water system was suggested to the chief engineer, but he said there was no such thing. The superintendent was then appealed to and he ordered every inch of the system explored until the by-pass was found. When it was finally located, the valve was seen to be wide open. There is no more trouble in that plant from bad feed water. And the order for the new boiler was canceled.

In this article the writer has attempted to show that feed water treatment is a real live problem, even in the plant where the water is known to be good. But guesswork was never known to make hard water soft. If worthwhile results are to be obtained accurate knowledge is necessary, after which the proper method of treatment may be selected to suit the conditions, always bearing in mind the human element that is going to mishandle the pesky thing.

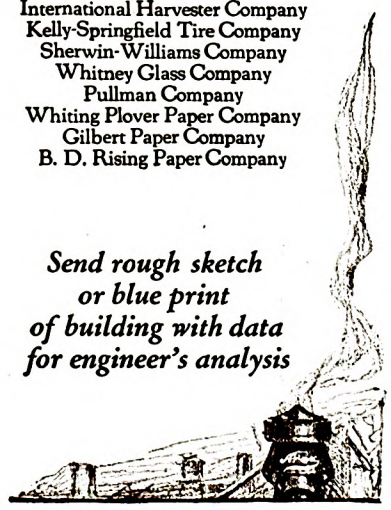




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Put your problem before these engineers for consideration. The specification blank below will bring you a complete survey without cost or obligation. Attach rough sketch or blue print of building and address Arex Company, Engineering Division 1583 Conway Building, Chicago.

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Construction of Building: State whether Brick ☐ Concrete ☐ Frame ☐ Stucco ☐

Type of Roof: State whether Flat ☐ Slant ☐ Gable ☐ Sawtooth ☐ Monitor ☐

Pitch of Roof..... State how many..... inches to the foot.....

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....
Firm Name Name of Individual Title of Individual

....
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What Cooper Union Means in the Engineering World

By May Wilkinson Mount

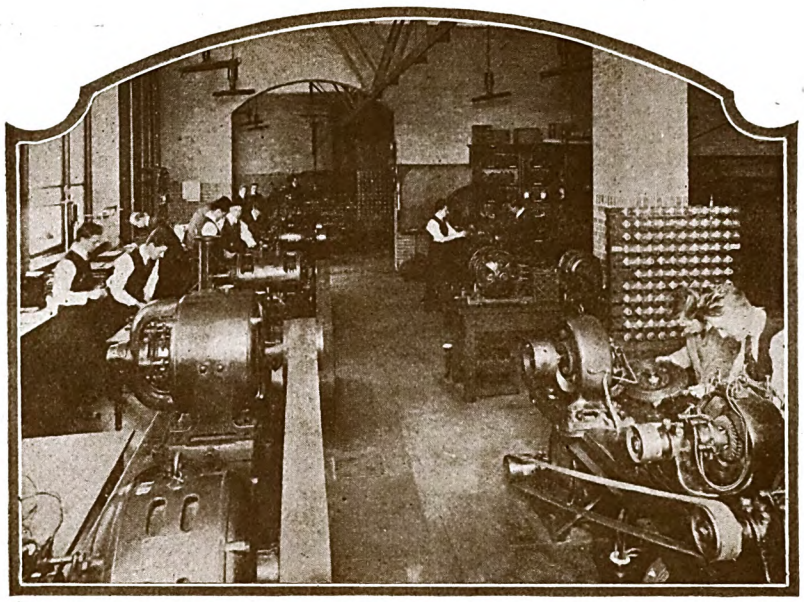
"SINCE Cooper Union raised $400,000 for the increase of teachers' salaries it has been the wish of its friends that a building fund might be provided for the erection of the much-needed upper floors planned to complete the Hewitt Memorial Building."

I read this announcement in the morning paper as the Third Avenue elevated train whirled past Cooper Square and the big brown building on Fourth Avenue and Eighth Street flashed, from its many windows, a smile caught from the morning sunlight.

Where could help be more effectively bestowed!

The long foundation of Hewitt Memorial Building glided by. Here is housed the splendid engineering equipment of Cooper Union; an equipment as complete as that of any university, although more restricted in quantity for lack of space.

How many who ride on the subways know that Ludwig A. Zima, electrical engineer of the Interborough Rapid Transit, won his degree in Cooper Union; that John F. O'Rourke, New York's most prominent engineering contractor; Allen Stirling, inventor of the Stirling boiler, and William Kent, author of "Kent's Mechanical Engineering Pocket Book" and a consulting engineer of note, won their professions in the old-fashioned building which Peter Cooper's vision and philanthropy erected for the use of all who were capable of achieving prominence in their ideals and who had not the opportunity to develop them?



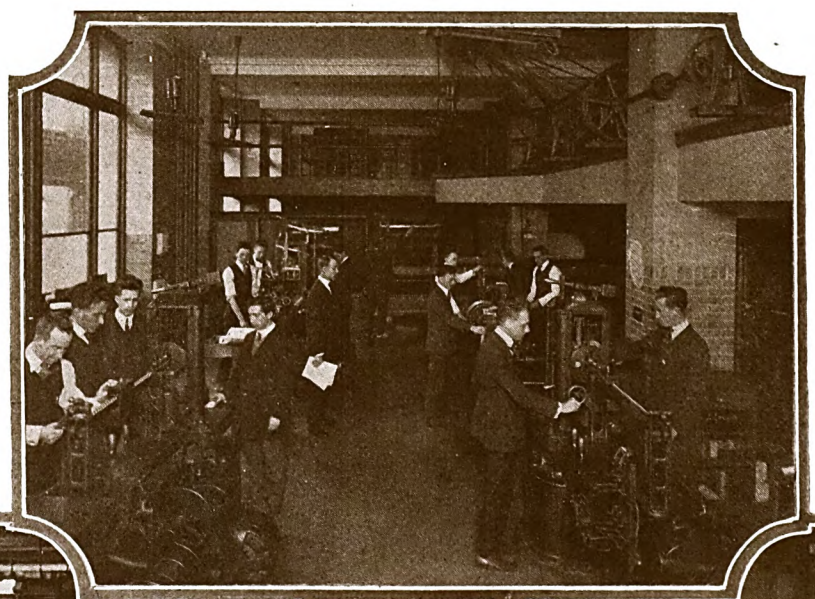
The Dynamo Laboratory, where budding electrical engineers receive practical instruction.

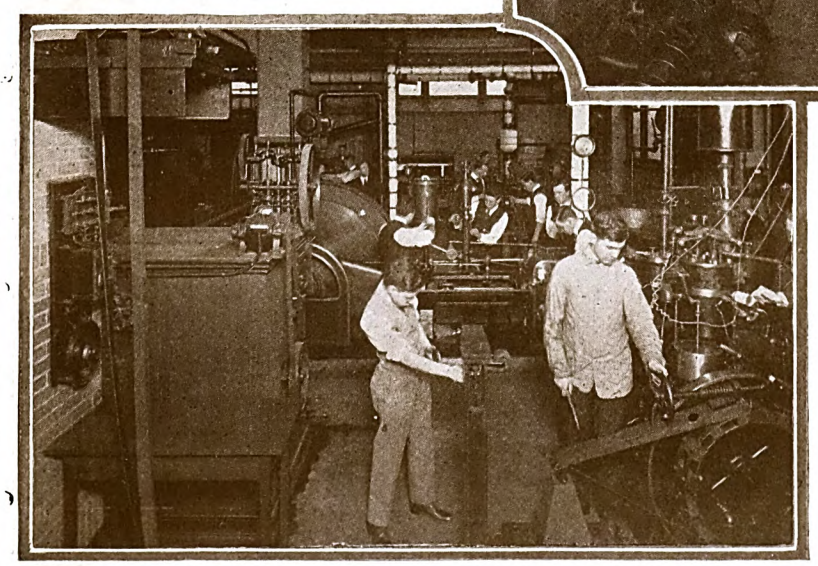
Year after year young men and women have graduated from Cooper Union's classes in arts, sciences and letters, every one of them an expression of the best brains in the city's fibre, for it must be remembered that lack of room and length of application lists makes it a necessity for Cooper Union to accommodate only the best material offered. Out of 1,500 youths who sought entrance into engineering courses this term, for instance, only 200 could be accepted. Only 300 are working in those modern laboratories where toilers of the day strive to lift themselves to heights in their chosen profession at night.

They succeed. The list of successes is long and brilliant. There are Edward A. Miller, Chief Engineer, Department of Parks for Manhattan and Richmond; George W. Rink, assistant superintendent of motive power, Central Railroad of New Jersey; Theodor S. Oxholm, Chief Engineer, Borough of Richmond; D. R. Lovejoy, manufacturer and inventor of atmospheric products

(Continued on page 42)

Below—Upper floor, Nationals Testing Laboratory.



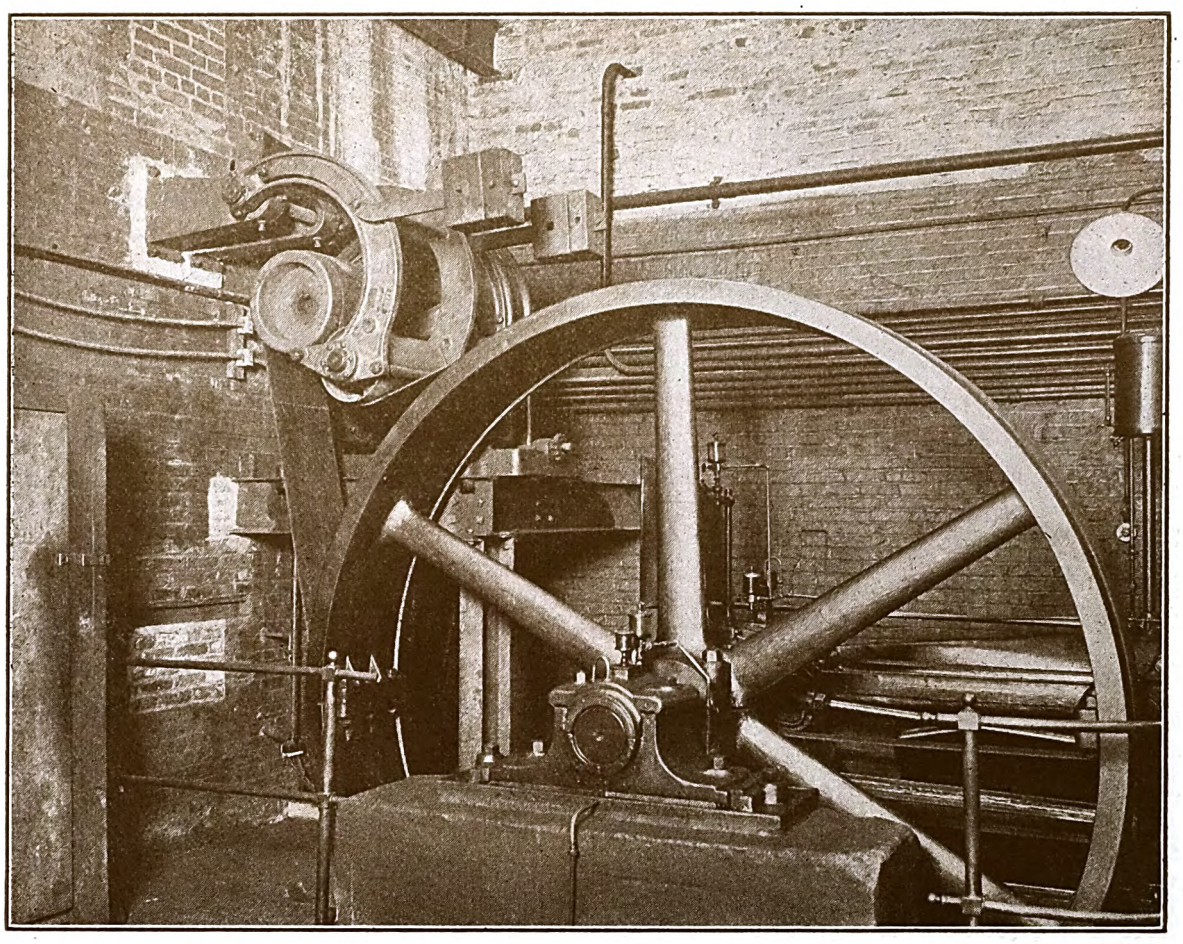


A section of the Thermodynamics Laboratory. At Cooper Union, the "idle student element" is conspicuous by its absence.



Materials Testing. Considering past accomplishments, Cooper Union is surely entitled to support in its ambition for enlarged facilities.

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Engine driven 90 K.W. Alternator, Alternator Pulley 17" dia. 18" face. 900 r.p.m. Flywheel 10' 0" dia., 22" face, 126 r.p.m. Pulley Centers 7' 6".

An Achievement in Belting Engineering

Five Points

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

The installation illustrated above shows the possibilities of the LENIX drive. Most people would have thought this impossible but to the LENIX it was simply another opportunity to demonstrate its ability to transfer power from one pulley to another regardless of the relative positions of the pulleys.

You may never have as unusual a belting problem as to this solve, but you will always want to save FLOOR SPACE—you will always want to save POWER.

The LENIX by "wrapping" the belt around the pulley makes the short center drive not only possible but preferable. The belt is held against the pulley surface by a pressure that is constant and accurate regardless of load, atmospheric conditions or belt stretch. Slippage is eliminated.

There are more than 3,000 LENIX drives in operation in this country. There would be some in *your* mill if you were familiar with the advantages of this drive. You can get the facts by writing for a copy of *"Saving Slippage and Space."*

F. L. SMIDTH & CO.

ENGINEERS

50 Church Street New York, N. Y.

THE LENIX DRIVE

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The Future of Belt Conveying

(*Continued from page 25*)

from a moving belt between the terminals of the conveyor. In its present form it is practically what it was fifty years ago, except that users of belt conveyors have come to understand that the light frames and small pulleys of old-time trippers are not good construction. To keep the belt running straight, the frame must be stiff and strong, and to lessen the injury to the belt by the reverse bending, the pulleys must be reasonably large. These features are embodied in the best trippers, but should be in more general use.

Further improvement in belt conveyor accessories will come in response to a demand for lower operating costs. The principal items in these costs are charges for care and maintenance, for power and for interest and depreciation. The prime cost which underlies all these charges is the cost of human labor, and in spite of some reductions and fluctuations, it seems certain that labor costs for years to come will not fall to the level of 1914. The high price of labor is quite evident to the owner of a belt conveyor when he pays wages and repair bills, but it is not so apparent in the bill he gets from the power company, or in his bills for bank interest. Nevertheless the price of labor is the fundamental basis of these items of expense also. There will be for years to come, in all branches of industry, a constant effort to reduce operating costs; this will lead to the greater use of labor-saving machinery, and a demand that belt conveyors as well as other kinds of conveying machinery shall be more efficient and cost less to run.

If belt conveyors could be run with no attention at all, the charge for care and supervision would be zero; but while that is not possible, it is practical to use belt conveyor equipment that will reduce greatly the charges for care and oversight. Belt idlers with ball bearings or roller bearings are steadily coming into use as a means to this end. In several idlers of this kind which have passed the stage of trial and introduction, the charge of lubricant is so confined by packing, and dust and dirt are so excluded, that one filling of lubricant lasts for months. This makes a direct saving in lubricant, but what is more important, it avoids most of the expense for filling and adjusting the screw-top grease cups with which the ordinary belt conveyor idler is fitted. In large plants where it takes several men to look after the belt conveyors, this saving is immediate and important. In small installations, where one man looks after all the machinery, the direct saving may be slight, but the added cost of the improved idlers may be saved in the lower charges for belt repairs and renewals.

Idlers with ball bearings or roller bearings revolve with so much less friction than pulleys with plain, grease-lubricated, bores that the saving of power is an important item. There are more than a dozen cases on record where the direct saving of power has been about 30% and in some very long conveyors, the saving has been as much as 50%. In small conveyors lightly loaded, the reduction in the cost of power may not be sufficient to justify idlers with ball or roller bearings, but in a permanent installation of long or hard worked conveyors carrying coal, ores or minerals, there is a better opportunity to show the direct saving and the ultimate economy in the use of the more expensive idlers.

Careful comparisons of costs of handling have shown in recent cases that as between a system of mine-car haulage and a system of belt conveyors four and a half miles long, the choice on the basis of ultimate cost per hour of material carried would be against the belt conveyors if they had ordinary grease cup idlers; but if the conveyors were equipped with improved idlers, the reduced cost of power and of care and maintenance, would make the conveyor system show a decided saving. In these comparisons, other factors in favor of the improved idlers were:

1. The pull in the belt is so much less that a thinner belt, and hence a cheaper belt, can be used. The belt will be

(*Continued on page 34*)

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The Versatility Of Hyatt Bearing Conveyors

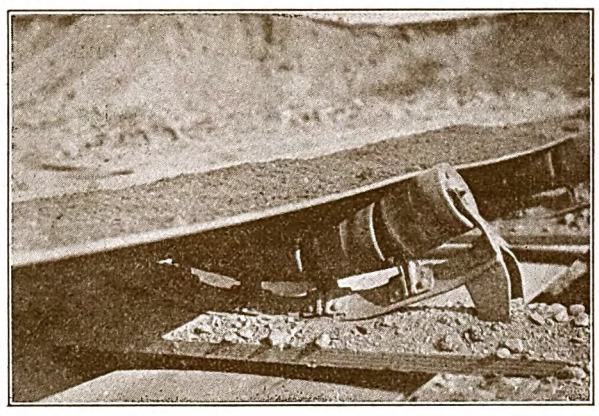
Speeding Up Materials Dependably At Lower Cost

Whatever type of material you have to handle, Hyatt bearing conveyors will do the work more quickly, more dependably, at a lower cost. In all industries,



Ore: *Heavy, abrasive. Hyatt bearing equipped conveyor drive at Phelps Dodge Corporation, Tyrone, New Mexico, installed in 1915. They report "Ultimate life of Hyatt bearings unknown, maintenance very low, service excellent".*

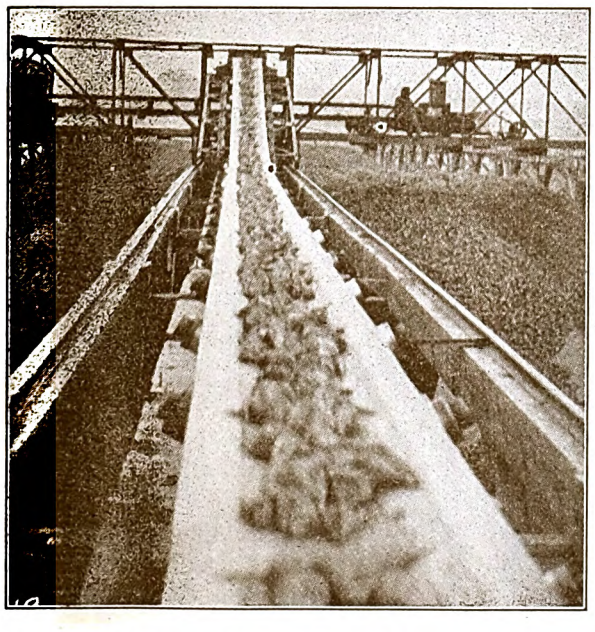
handling all varieties of materials from fragile, light loads to heavy, abrasive loads; conveyors with Hyatt bearings built into their idler, head, tail bend and snub pulleys are



Sand: *Exposure to elements does not affect the dependable, economical operation of Hyatt bearing idlers on sand and gravel conveyors such as this one used by the Rubber City Sand & Gravel Company, Akron, O.*

proving their worth day after day.

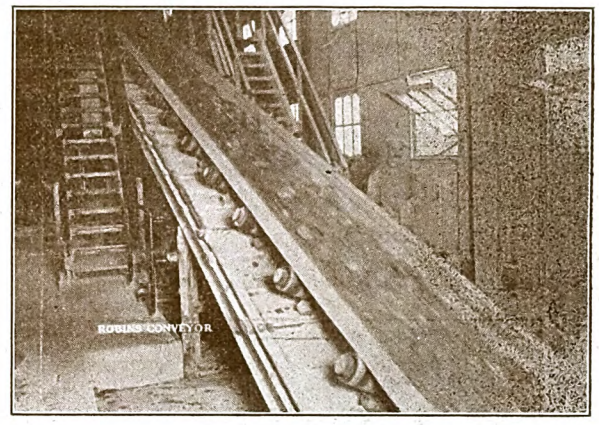
Power Saving: The elimination of at least 50% of the friction of plain bearings makes possible the use of



Beets: *Dirt and moisture conditions surround conveying of beets and beet pulp. Great Western Sugar Company says, "Our Hyatt bearing beet conveyors are the best installation of the kind of which we have any knowledge".*

smaller driving motors, lighter head and tail pulleys and reduces operating power costs.

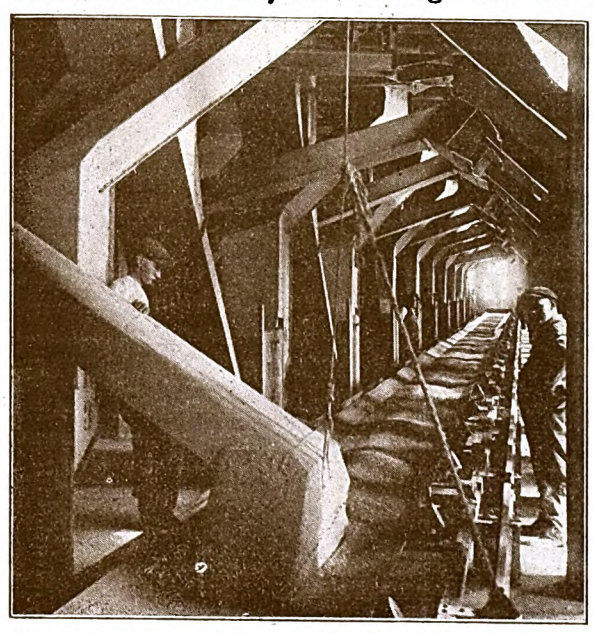
Belt Cost (Initial and Replacement): The reduced friction in idler pulleys allows the use of lighter, less costly belts. When 6-ply belts can be used in place of 8-ply belts a considerable saving in first belt costs and belt



Limestone: *Extremely abrasive. 10% of the World's limestone carried by Hyatt equipped conveyors at Hillsville, Pa. plant of the G. W. Johnson Limestone Company, subsidiary of Carnegie Steel Company. Constant operation for five years, no time lost, not one cent for repairs to date, lubricate three to four times a year.*

replacement costs results.

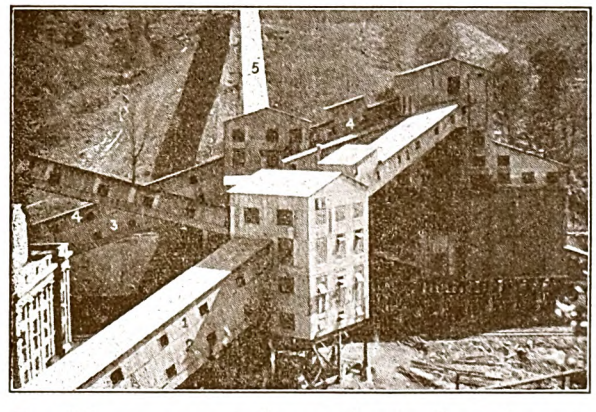
Maintenance: Hyatt bearings are durable and operate



Grain: *High speed, thick dust. Seventy-five Hyatt bearing conveyors (4½ miles long, 32,000 bearings) at Pennsylvania Railroad elevator, Baltimore, Md., handle forty cars of grain per ten hour day. No time lost for repairs, lubricate three to four times a year, no hot bearing fire hazard.*

for many years without requiring adjustment or replacement.

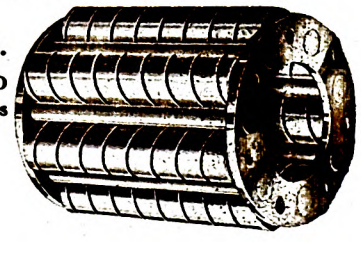
Lubrication: Hyatt equipped conveyors require greasing only three to four times a year. A real saving in grease and the labor to apply it.



Coal and Slate: *Heavy shock impacts under loading chutes. The coal for all the coke to supply the United States Steel Company plants is carried on five Hyatt bearing conveyors at Unites States Coal & Coke Company, Lynch Mines, Ky.*

It will pay you to investigate the advantages of Hyatt bearing conveyors for your material handling requirements.

HYATT ROLLER BEARING CO.
Newark Detroit Chicago San Francisco
Worcester Milwaukee Huntington Minneapolis
Cleveland Pittsburgh Buffalo
Philadelphia Indianapolis



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(*Continued from page 32*)

lighter and less power will be required to keep it in motion.

2. Since there is less chance that the pulleys will refuse to turn, the risk of injury to the belt is less.

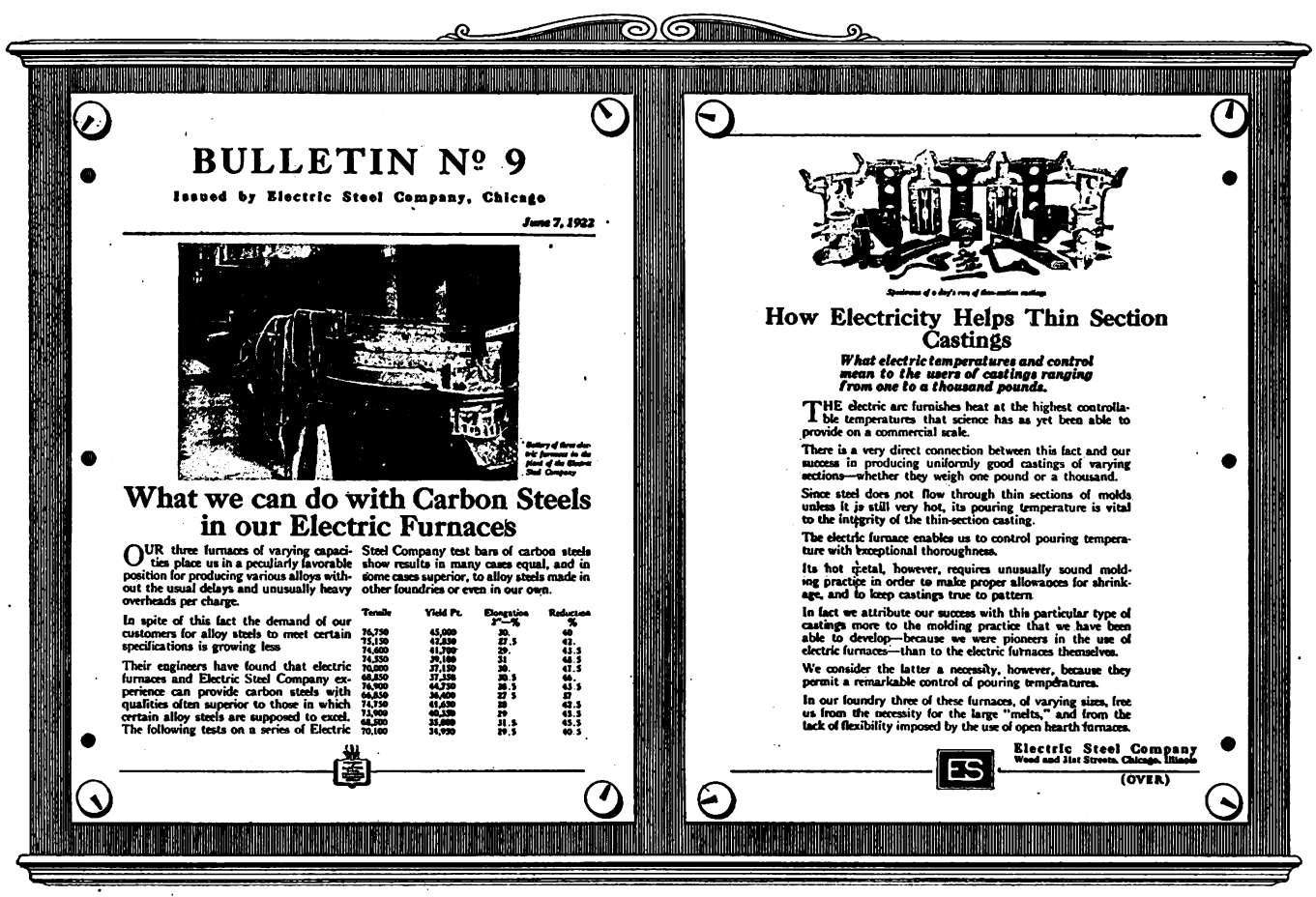
When a modern rubber belt successfully and economically carries hard ore in jagged pieces weighing 200 pounds or more, and when canvas belts are regularly used to convey all sorts of heavy merchandise and packages, we may say that the art of belt conveying has made progress. Such uses would not have been practical 30 years ago, and we may safely say that 30 years from now belts will be doing work that is not now thought of.

Great developments may be expected in the use of package conveyors. For years these were confined to department stores, but more recently they have been used in post-offices, in express terminals, and in manufacturing plants of all kinds. The article "Handling 3,000 Tons of Mail a Day" in the recent January number of "Industry Illustrated" shows the trend of the times in a recent installation where 71 conveyors using 8 miles of wide belt will be used to collect, sort, distribute and dispose of an immense quantity of parcels post mail matter. This plant may be considered the forerunner of other mail handling plants of this type.

In shops and factories belt conveyors will be used more and more to carry raw materials to machines, partly-worked goods from one machine to another, and finished goods to storeroom or to cars. In the form shown in the upper and lower left-hand pictures on page 24, both runs of the conveyor can be used at the same time, and in shops designed for the purpose and with the machines or operators' benches arranged alongside the conveyor, the output of the workers can be increased while the cost of handling is greatly reduced.

It is also probable that great economies in costs can be effected by novel combinations of belts with other means of handling materials. It is not so many years since the first lake steamer was fitted with a belt conveyor to assist in discharging its cargo; now there are a number in use in which a belt conveyor over the keel draws coal or stone from a hoppered bottom, an inclined belt elevates it, and another belt in a pivoted boom finally discharges it on the wharf alongside the ship. There are possibilities in the greater use of belt conveyors in discharging ships' cargoes. The same may be said of the combination of belt conveyors with locomotive cranes for storing and reclaiming large quantities of coal, ore and similar materials in the open, and in the greater use of portable belt conveyors.

Even in Japan, where labor costs are low, it has been found profitable to use portable conveyors to store and reclaim material which a few years ago was moved by human muscle only. High speed belts for throwing material into the ends of box-cars or trimming coal in the holds of ships are instances of new uses of belt conveyors; it is probable that other uses for high speed belts



BULLETIN Nº 9

Issued by Electric Steel Company, Chicago

June 7, 1922

What we can do with Carbon Steels in our Electric Furnaces

OUR three furnaces of varying capacities place us in a peculiarly favorable position for producing various alloys without the usual delays and unusually heavy overheads per charge.

In spite of this fact the demand of our customers for alloy steels to meet certain specifications is growing less

Their engineers have found that electric furnaces and Electric Steel Company experience can provide carbon steels with qualities often superior to those in which certain alloy steels are supposed to exceed. The following tests on a series of Electric Steel Company test bars of carbon steels show results in many cases equal, and in some cases superior, to alloy steels made in other foundries or even in our own.

Tensile	Yield Pt.	Elongation 2"—%	Reduction %
76,750	45,000	30.	60
75,150	42,850	27.5	62.
74,600	41,700	29.	61.5
74,350	39,100	31	66.5
70,000	37,150	30.	67.5
68,850	37,350	30.5	66.
76,900	44,750	28.5	63.5
66,850	36,600	27.5	57
74,750	41,650	28	62.5
73,900	40,350	29	65.5
68,500	35,000	31.5	65.5
70,100	34,950	29.5	60.5

How Electricity Helps Thin Section Castings

What electric temperatures and control mean to the users of castings ranging from one to a thousand pounds.

THE electric arc furnishes heat at the highest controllable temperatures that science has as yet been able to provide on a commercial scale.

There is a very direct connection between this fact and our success in producing uniformly good castings of varying sections—whether they weigh one pound or a thousand.

Since steel does not flow through thin sections of molds unless it is still very hot, its pouring temperature is vital to the integrity of the thin-section casting.

The electric furnace enables us to control pouring temperature with exceptional thoroughness.

Its hot metal, however, requires unusually sound molding practice in order to make proper allowances for shrinkage, and to keep castings true to pattern.

In fact we attribute our success with this particular type of castings more to the molding practice that we have been able to develop—because we were pioneers in the use of electric furnaces—than to the electric furnaces themselves.

We consider the latter a necessity, however, because they permit a remarkable control of pouring temperatures.

In our foundry three of these furnaces, of varying sizes, free us from the necessity for the large "melts," and from the lack of flexibility imposed by the use of open hearth furnaces.

Electric Steel Company
Wood and 31st Streets, Chicago, Illinois

(OVER)

How electricity has compelled swift advances in steel founding

WHEN the electric furnace first made possible a higher pouring temperature than could be attained with the open hearth, foundry practice for many years lagged behind the advance made in melting.

Molds, sands and inspection

New molding methods had to be devised to accommodate the hotter metal. New devices for testing and controlling sand mixtures had to be created. New ladle linings had to be compounded. More rigid and systematic inspections—both of the interior and exterior of the castings—had to be installed and enforced.

Research and swift progress

Only in the last three years have these and many other necessities been achieved—and then only through the combined efforts of the Electric Steel Founders' Research Group. To the industry as a whole this means that more is now known about the art of organized steel founding than has ever been known anywhere before.

Send for these bulletins

To the purchaser it means—among other things—that in many cases he can now replace gray and malleable iron with exceptionally strong, tough, and elastic steel costing less for the part than iron costs. For additional information send for our D series of 28 bulletins briefly describing the work of the Electric Steel Founders' Research Group and the Electric Steel Company.

Electric Steel Company · 31st and Wood Streets · Chicago

ELECTRIC STEEL COMPANY

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will be discovered and developed in the future.

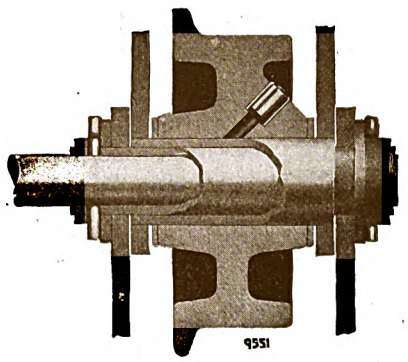
When material is once safely settled on a belt, it can be conveyed, so far as the belt is concerned, just as easily at 1,000 feet per minute as at 200 feet per minute, provided the resistance of the air does not blow the material off. At present, belt speeds for most materials are kept relatively low to suit the ordinary conditions of loading the belt and to avoid excessive friction losses in the supporting belt idlers. By the use of improved idlers the friction losses can be reduced greatly, and by means of improved loading devices and chutes, the delivery to the moving belt can be made with less cutting and abrasion. It seems likely, therefore, that with more attention paid to these points, ordinary belt conveyors can in the future be run safely and economically at speeds higher than what is now considered good practice.

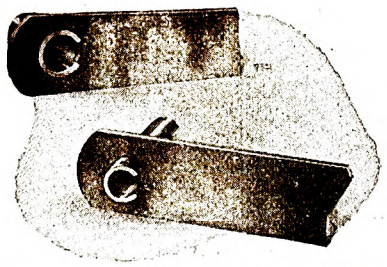
The use of a series of belt conveyors in tandem to convey coal 4½ miles has been referred to in this article. Such a system composed of 22 belts 48 inches wide and up to 1,500 feet centres is now under construction, and a 10-mile system with 60-inch belts is under consideration. What has made such a system possible is the use of supporting idlers with ball or roller bearings and a greater permissible belt tension. Twenty years ago it was not considered proper to stress a conveyor belt higher than 18 or 20 pounds per inch of width per ply of thickness, but with better belts and greater experience in the use of belts, it has been found safe to run the tension up to 30 pounds per inch per ply. With continued improvements in the manufacture of belts, some of which have been referred to, it is not improbable that belts may be stressed even higher and that belt conveyors 2,000 feet centers may become as commonplace as 500-foot conveyors are now.

The progress of belt manufacture may be appreciated when we remember that the first rubber belt used for grain conveying 60 years ago was only 18 inches wide, 2 plies thick, and less than 100 feet long, and that in conveyors for heavy substances, there were, prior to 1900, very few over 24 inches wide. In 1915 the largest belt in use was 54-inch, 11 ply, 1500 feet long and in 1917 there were several 60-inch, 12 ply belts over 2,000 feet long in active service. Since that time 60-inch belts are not unusual and in some of the large rubber belt factories, they are made in the general course of business without exciting comment.

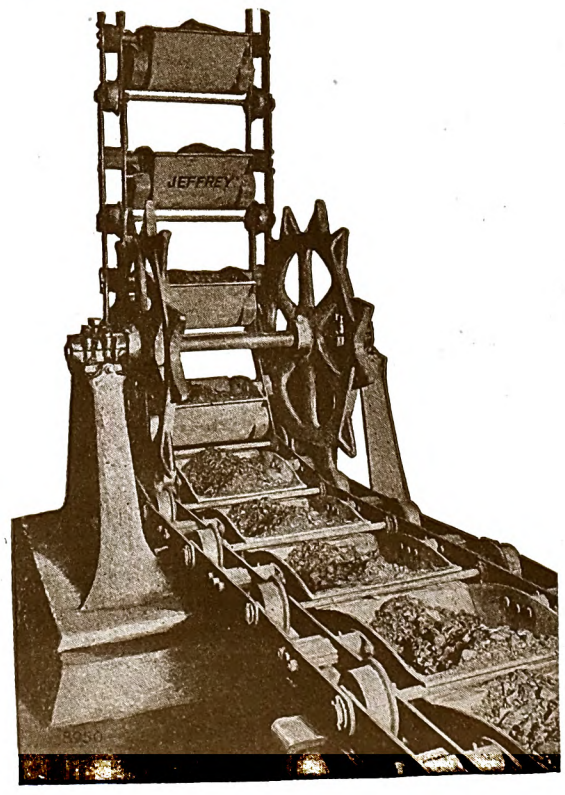
The difficulties in the way of making belts wider than 60-inch and thicker than 12 ply, are not very great and it is probable that they could be supplied. A 10-foot wide belt will of course carry four times as much as a 5-foot wide belt at a given speed and it is conceivable that to give a certain capacity a single 10-foot conveyor might be cheaper and better than four conveyors 5 feet wide under certain conditions.

All Wear In The Jeffrey Carrier Chain Joints Is Confined To The Renewable Glass Hard Steel Bushings





Showing how lugs in the steel side bars are locked tight to notches in both ends of the bushings.



The life of any Pivoted Bucket Carrier in rigidity and in proper action on its driving wheels depends almost entirely upon the life of its chain joints—therefore the Jeffrey Carrier is equipped with Chains made of tough steel side bars with hardened double bushings.

These two steel bushings are assembled one within the other, the outer one fixed to the inside bars and the inner bushing fixed to the outside bars. The outer bushings serve as bearings for the chain rollers, while the inner bushings act as chain pins and receive the carrier cross rods.

The lugs in the steel side bars are locked tight to notches in both ends of the bushings. Thus all wear is confined to the bushings which may easily be replaced after long service and a practically new chain obtained at very little cost.

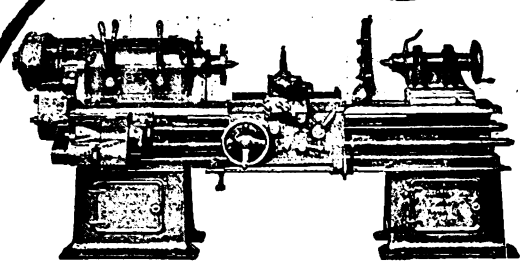
At The Ford River Rouge Plant A Jeffrey Carrier Is Demonstrating Its Economy And Efficient Performance

The Jeffrey Manufacturing Co.,
946-99 North Fourth Street Columbus, Ohio

JEFFREY
MATERIAL HANDLING MACHINERY

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REED-PRENTICE
MACHINE TOOLS



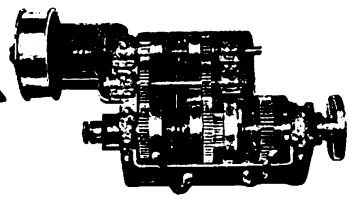
All the users are big boosters for it.

THE unapproached daily service given by Reed-Prentice Geared Head Lathes in hundreds of plants gives them nation wide prestige.

Advanced design—more accurate and rugged construction—handy simplified control—and a dozen other superior features—set Reed-Prentice Geared Head Lathes as a standard by which others are compared.

They are built in sizes 12"-14"-16"-18"-24"-27".

We will gladly explain all their fine points. Which size are you considering?



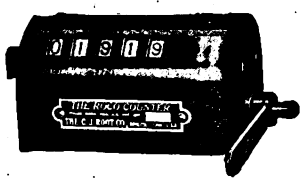
REED-PRENTICE CO.

LATHES-RADIAL DRILLS
BECKER MILLING MACHINES
MILLING CUTTERS



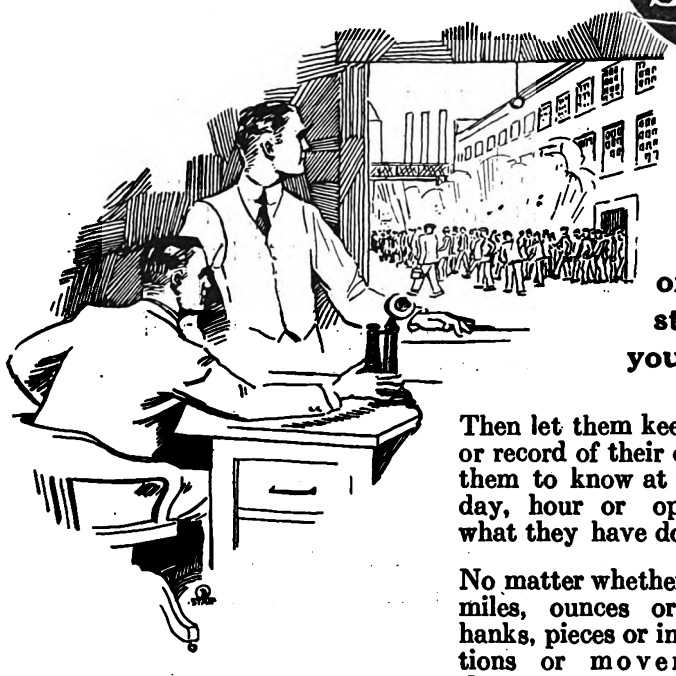
RAPID PRODUCTION LATHES
WHITCOMB PLANERS
SPECIAL MACHINERY

WORCESTER, MASS.
677 CAMBRIDGE ST.,
Branch Offices and Agents Throughout the World



THE SOLUTION

Do You Want To Avoid Strikes ?



or misunderstanding with your employes?

Then let them keep accurate count or record of their own work—allow them to know at the end of each day, hour or operation—exactly what they have done.

No matter whether this is inches or miles, ounces or tons, picks or hanks, pieces or individuals, operations or movements—***Root Counters can give an accurate and verified record of it.***

Why not allow our Engineers to come to your plant, at no cost to you and see what they can save by suggestions.

ROOT
BRISTOL, CONN.

Production *Plus*

(*Continued from page 13*)

Leaving the cylinder block machining group we next come to the tractor piston machining unit. Here, in Fig. 12, we note that the machines are driven in groups, the countershafts and jack-shafts being suspended on steel skeleton structures. The ability of a piston to roll easily has been availed of by the Ford engineers in handling their transportation, for they roll from one machine to another on simple tracks composed of parallel pairs of angle irons.

From this point to the northern end of the shop is space as yet largely unfilled and reserved for additional machining units. Eventually all of the Ford cast iron machining will be cared for at River Rouge. Some of it, made at the Highland Park foundry (which will also be abandoned shortly) is now machined at Highland Park. The car cylinder head job is now being transferred and the machine unit at River Rouge is nearly ready to take over this work.

Following the finished stock conveyor through the opening in the northern wall of the building, we come to its terminus in a shipping platform. As shown in Fig. 13, this is provided with roller conveyors for ease in loading the freight cars which are spotted against the doors at either side of the loading platform.

The large and medium size machine tools at River Rouge are driven by individual motors which are either geared or belted directly to the tools. As a result the space above the machines is free from belts. Being thus unobstructed it can be utilized for work handling equipment. Fig. 14 gives a good illustration of this. It shows the second milling operation on the Ford cylinder blocks and it also shows how completely utilized is every available foot of floor space. The "business end" of this same operation is shown in the next picture, Fig. 15. Twelve cuts are being taken at one time on the cylinder tops and sides. Work of this sort naturally calls for frequent cutter replacement and brings up the subject of cutter grinding. This is decentralized because of the size of the plant and cutter grinders are located in the various machine units. Auxiliary tool repair departments and tool issue rooms are also to be found at convenient locations, although the making of these cutters is centralized in the main tool room in the B building.

Tool set-up on the various machines is not cared for by the machine operators, but by special set-up men each of whom is responsible for a certain operation or a number of machines. Sometimes the set-up man is really the foreman or sub-foreman. This varies according to the nature of the work and its needs. Machine repair is performed by traveling repair gangs operating under the jurisdiction of the tool room superintendent, and that are sent from one place to another as required. Lubrication is also a function which comes under tool room jurisdiction, the philosophy back of this being that the greater proportion of breakdowns in the average plant is due to lack of oil. This is avoided at River Rouge by systematic and regular oiling. The larger machines are all equipped with multiple oil feed systems having conductor pipes leading to the principal bearings. Tool coolant consists of an oil emulsion which is pumped through the plant and delivered to each machine.

In a plant where the production is on such a huge basis the disposal of chips becomes a problem in itself. Wherever possible this is cared for by automatic transportation as in the case of the battery of cylinder boring machines shown in Fig. 16. Here we see that underneath the stock-carrying conveyor is a belt conveyor for handling chips mounted on the same frame as the stock conveyor and thus requiring no additional floor space. At the left in this same picture are to be seen tote boxes used for handling chips in bulk and which are picked up by the overhead traveling crane.

A good idea of the closeness

(*Continued on page 39*)

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PROCRASTINATION

will only increase your losses under the Workmen's Compensation Act

Install

Golden-Anderson

Double Extra Heavy Valves



before that boiler tube bursts. Why procrastinate and gamble on the lives of your men in the boiler room? In the steel industry, they are safeguarding hundreds of lives daily by standardizing on

Golden-Anderson Automatic Double-Cushioned Triple-Acting and Non-Return Valves—

Why? Here is the answer. They

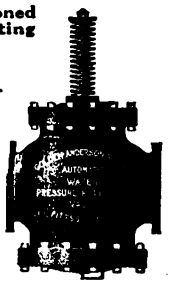
1. Automatically cut out a boiler the instant that a tube ruptures or other internal break occurs.
2. Automatically cut off the steam flow from every boiler the instant that a steam pipe bursts.
3. Automatically equalize the pressure between all boilers.
4. Automatically cut in a boiler making accidents due to inaccurate steam gauge impossible.
5. Positively prevent back flow of steam into a cold boiler.
6. Can be closed by hand, like ordinary stop valve, and arranged with "combination feature" to open valve like regular gate or globe valve.
7. Can be tested in service from the boiler room floor.
8. Double Corliss Dash Pot that cushions in opening and closing.
9. Cannot pound, spin, stick or chatter.

Over 4100 used in the large steel companies



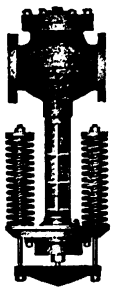
GOLDEN-ANDERSON
Pat. Cushioned Water Relief Valves

1. Automatically relieve excess pressure.
2. Prevent stress, strain and bursting of mains.
3. Correct mechanical construction.
4. Perfect air and water cushioning.
5. No metal-to-metal seats. No hammering or shocks.
6. Angle and globe pattern. Sizes 3 to 30 in.



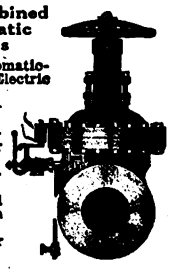
GOLDEN-ANDERSON
Pat. Automatic Cushioned Water Pressure Regulating Valves

1. Maintain a constant reduced pressure regardless of fluctuations on high pressure side.
2. Perfectly Cushioned by water and air. No metal-to-metal seats.
3. The best valve made for maintaining a constant low pressure where consumption is continuous.
4. Operates quickly or slowly as required—No attention necessary.
5. Positively no hammering or sticking. Sizes to 24 in.



GOLDEN-ANDERSON
Pat. Automatic Cushioned Steam Pressure Reducing Valves

1. Maintain a constant reduced pressure.
2. Thoroughly cushioned.
3. No hammering, chattering or sticking.
4. No auxiliary valves or small by-passes to clog up.
5. No wire drawing.
6. Only one adjustment from the outside.
7. Double extra heavy throughout—practically indestructible.



GOLDEN-ANDERSON
Pat. Cushioned Combined Throttle and Automatic Engine Stop Valves

1. Operate 3 ways: Automatically, by Hand, or by Electric Switch.
2. Prevent Fly-wheel Explosions.
3. "Double Corliss" Cushioned—No Pounding or Sticking.
4. Contains No Tight Fitting Parts.
5. Furnished in Angle and Globe Patterns for High or Low Pressures.
6. "Always Ready for Service."

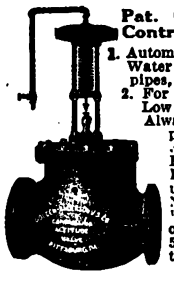
GOLDEN-ANDERSON
Pat. Automatic Double Cushioned Check Valves

1. Especially adapted for Water Service.
2. For High or Low Pressure.
3. Thoroughly Cushioned. No chattering, Hammering, or sticking.
4. Globe or Angle Patterns up to 30 in.
5. Especially adapted for hydraulic elevator service.



GOLDEN-ANDERSON
Pat. Cushioned Automatic Controlling Altitude Valves

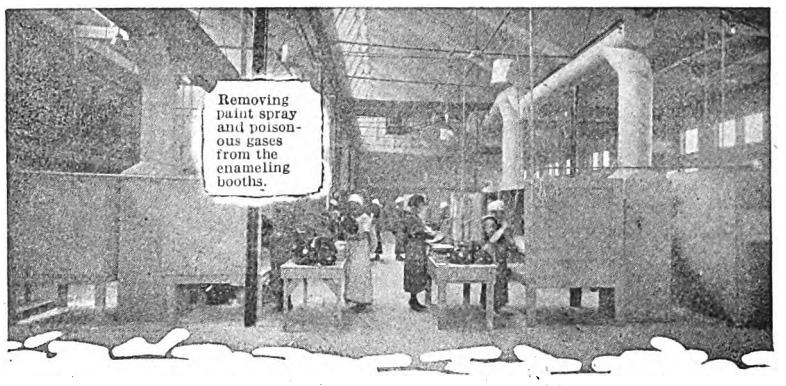
1. Automatically Maintain uniform Water Levels in Tanks, Standpipes, Reservoirs, etc.
2. For High or Low Pressure. Always Dependable.
3. No Floats or Fixtures used. 4. No Water Hammer or Shocks. 5. Sizes up to 30 in.





Golden-Anderson Valve Specialty Co.

1306 Fulton Building **Pittsburgh, Pa.**



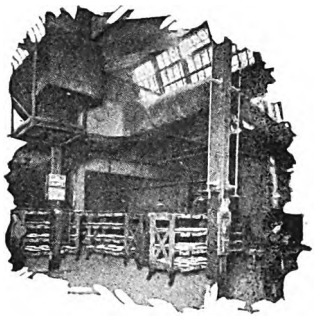
Benjamin Electric knows the value of putting moving air to work—

AT the Benjamin Electric plant at Desplaines, Illinois, moving air, supplied by Clarage-Kalamzoo Fans Blowers and Exhausters is serving in some mighty profitable applications.

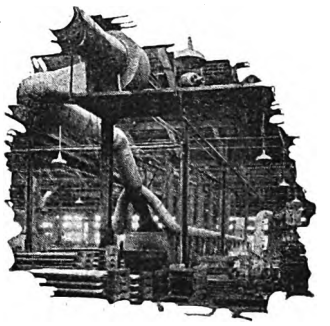
Five installations have been made since 1918. As shown in the illustrations, fans, blowers and exhausters are used to exhaust spray and gases from the enameling booths, to distribute cool air in front of the baking ovens, to draw waste heat from the furnace stacks and carry it to the drying room, to carry heated air from the drying room to the pickling room and to supply heated air for a continuous dryer and for heating.

This same industrial force-moving air—will cut your operating costs, too. Supplied by Clarage-Kalamazoo equipment it is conveying light materials through pipes cheaply, is exhausting dust, dirt, and gases, is preventing condensation, is cutting the cost of drying, is supplying mechanical draft, is removing waste heat from kilns and ovens and diverting it to heating systems and is serving in a hundred and one miscellaneous ways.

Investigate—know the profit-making possibilities of moving air.



Here Clarage-Kalamazoo Fans distribute cool air to the men working in front of the drying ovens.



This system sends waste heat from the stacks to the drying ovens, then to the pickling room, then to the heating system. Costs are sharply cut.



Another view of exhausters that are used to draw paint spray and gases from enameling booths.

Clarage Fan Co., Kalamazoo, Michigan

New York City	Memphis
Minneapolis	Philadelphia
Cleveland	Chicago
Pittsburgh	Indianapolis
Detroit	Rochester, N. Y.
Los Angeles	

New England Elec. Equip. Co., Boston

Complete stocks carried in New York, Pittsburgh and Memphis

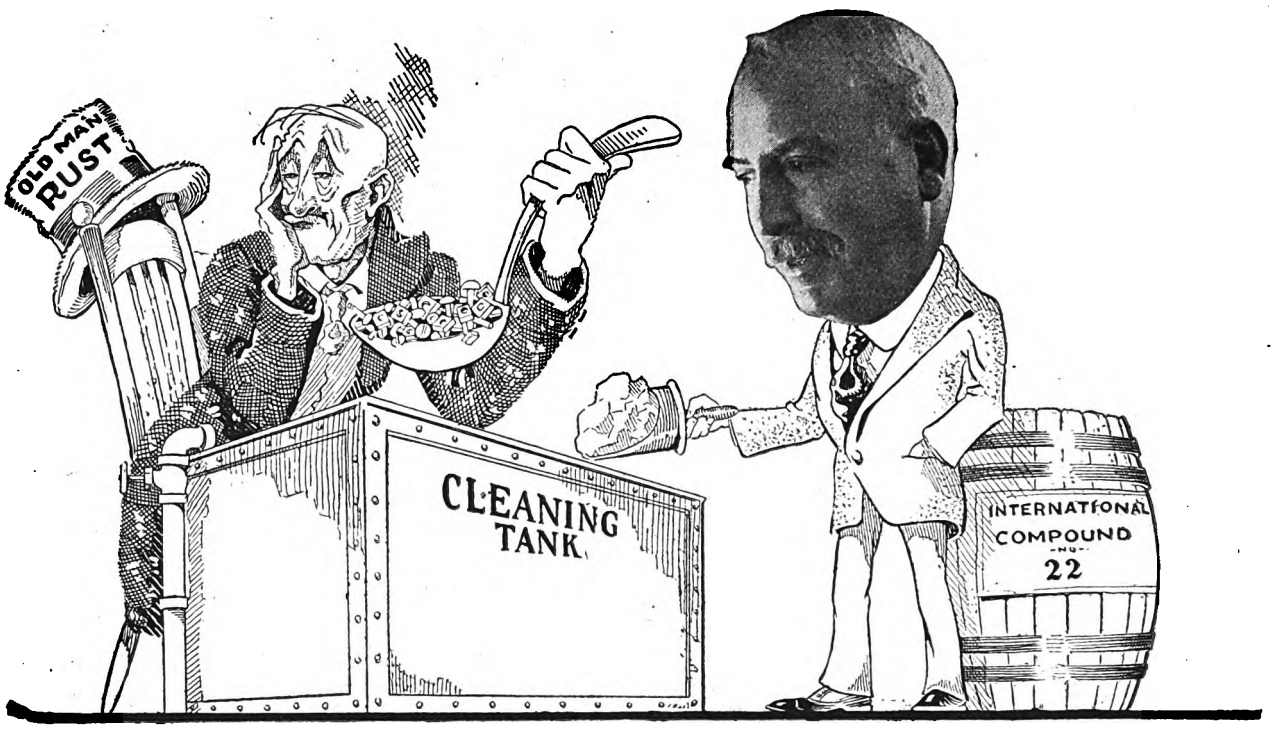
Want this booklet?

This booklet gives briefly some of the ways in which fan equipment is cutting operating costs, is speeding production and is making working conditions better. There's a copy for you; just tell us where to mail it.



CLARAGE KALAMAZOO Multiblade Fans

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Old Man Rust cannot eat metal parts cleaned with International Compound No. 22 at 6c per pound

ONE of the troubles I run into most frequently is the rusting of screw machine products which are stocked for any length of time.

Recently I was called in by a large concern which was having a great deal of trouble with rusting. As the pieces came from the machines covered with lard and machine oil, they were very carefully cleaned and then dipped into oil to prevent rusting. In spite of all the care they exercised rust always appeared under the oil after the parts had been stocked for awhile. This of course was due to something which had been left on the metal through improper cleaning.

Four ounces to the gallon of our INTERNATIONAL COMPOUND No. 22 at 6c per pound cleaned the parts beautifully. Old Man Rust just couldn't touch them.

This cleaner leaves a white coating on the metal which is a Jim Dandy rust preventer. It combines readily with any oil which may be used later on as a permanent rust preventer.

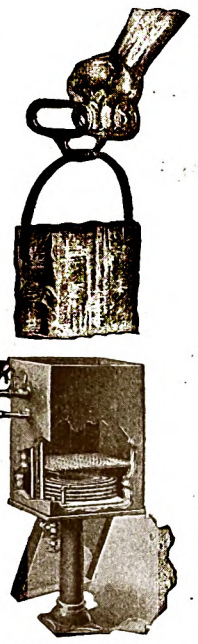
Here's a real cleaner that prevents rust and its cost is only 1½ cents a gallon. Let me send you a barrel of INTERNATIONAL COMPOUND No. 22. Use it; check up costs and results and if the No. 22 don't beat your present cleaner forty ways send it back and you don't owe us a cent. Let's hear from you folks who are willing to be shown.

Internationally yours,
John Bright

International Products
I.C.
International Chemical Co

INTERNATIONAL CHEMICAL CO.
PHILADELPHIA ~~~~~ PENNA.

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Uses 25% less ice

This square cooler uses 25% less ice

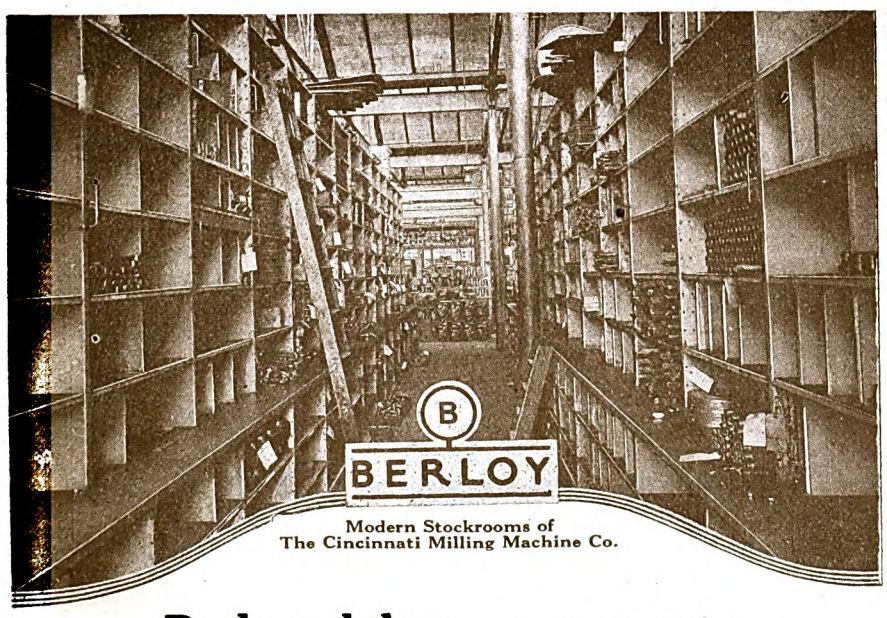
ANY manufacturer using Jewett *Square* Water Coolers will gladly verify this statement. But the fact that by being square they take ice in a cake and eliminate the need for cracking it into small pieces, makes this obvious. Then, too, as it takes time to crack ice, they also save in labor—so that in the installation of Jewetts you really perform a double economy.

Jewett *Square* Water Coolers installed in connection with the regular water system hygienically provide an ample supply of refreshing, cooled drinking water that offsets the energy-sapping effect of hot weather by keeping your workers refreshed and invigorated.

Literature covering the economy of Jewett *square* design in detail—as well as the convenient, sanitary angle-flow bubbler and many other advantages—will gladly be mailed, together with prices, upon request.

The Jewett Refrigerator Co.,
Established 1849
36 Chandler St., Buffalo, N. Y.

JEWETT
SQUARE WATER COOLER
Uses 25% less ice



Modern Stockrooms of
The Cincinnati Milling Machine Co.

Reduce labor—save waste

Our steel stock bins provide the right sized space for each stock item—they are quickly adjusted to fit changing requirements. At no time need there be wasted space. Stocks are kept better, are easier to locate and require fewer employees to handle. Write for our illustrated catalog No. 50 which shows some of our installations for prominent concerns. We helped them get better results at lower cost and we can help you.

The Berger Manufacturing Co., Canton, O.

BRANCHES: Boston New York Philadelphia Chicago
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Berloy Steel Storage Bins

(*Continued from page 36*)

of machine placing is given by Fig. 17 which shows the face milling of the ends of the Ford car cylinders. In the center of this picture is the gravity roller conveyor which brings the work to these machines. An ingenious method of doubling production is shown in the utilization of a two-story work table in this and the succeeding illustration. The lower tier of cylinders is held in place by clamping screws which extend through the top table while the top row is held by clamp bolts located in the two end cylinder holes. Special nuts and wrenches are provided to facilitate the quick clamping of these cylinders.

By far the greater proportion of machine tools used at River Rouge, as at Highland Park, are standard production tools. Where special equipment is required as in the cases of the line reaming machine in Fig. 19, the multi-spindle drills in Fig. 20, and the camshaft hole boring lathes in Fig. 21, the tools are usually designed by the Ford engineers and built by various machine tool manufacturers to the Ford specifications. For some operations, however, it seems impossible to get away from the good old-fashioned engine lathe, as in turning and facing the transmission flange of the car cylinders, shown in Fig. 22. Notice in this illustration the very convenient location of the emery wheel which is used for tool dressing, and which is just back of the operator.

Many thousands of pounds of babbitt must be melted daily to take care of babbitting some fifteen thousand bearings each twenty-four hours. Thus the department shown in Fig. 23 is an extremely busy one. One of the babbitting jigs is shown open in the foreground at the right and another one closed and ready to pour with the cylinder in place is to be seen in the central background. After each cylinder has been poured it is slid up the sheet iron incline to the conveyor shown at the left which carries it around a loop and back past the high speed gate trimming machines shown at the left. The castings pass through these machines exactly as wooden blocks pass through a buzz planer and the surplus

(*Continued on page 41*)

A New Vision in Development Work

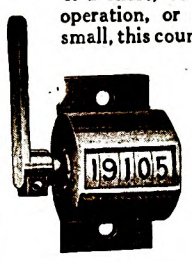
The inventor, patiently watching the performance of a new machine, tries one expedient after another for bettering its rate of production.

Every noticeable gain registers on his mind—but more surely and precisely will it register on a *Veeder Counter.*

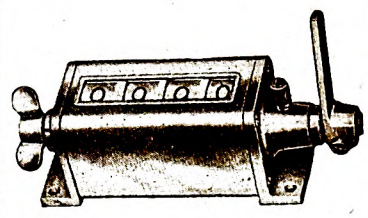
If you wish to know the slightest variation in the output; if you want an accurate indication of how each development affects *results,* then attach a

Veeder
COUNTER

The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation, or product. Though small, this counter is very durable; its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines, and most adaptable to experimental work. If run backward the counter subtracts. Price $2.00. (*Cut 3/5 size.*) Small Rotary Ratchet Counter, to register reciprocating movements of small machines, also $2.00



The Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



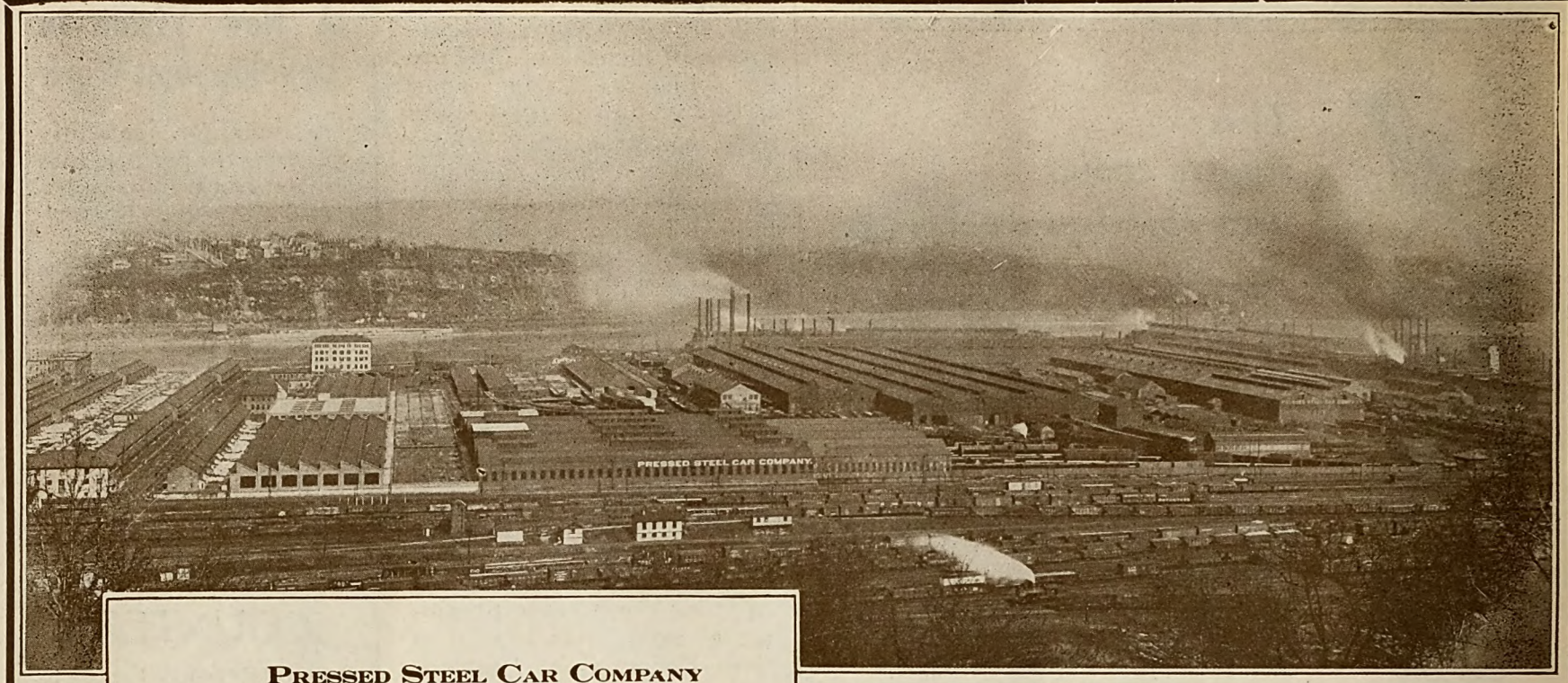
Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price, with four figure-wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter, to record reciprocating movements as on punch presses, $11.50 (list).

FREE—This new 80-page booklet shows everything you could ask in a counter. Ask for IT.



The Veeder Mfg. Co.
63 Sargeant St., Hartford, Conn.

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PRESSED STEEL CAR COMPANY
PITTSBURGH, PA.
BUILDERS OF FREIGHT AND PASSENGER CARS
OFFICES AT NEW YORK, PITTSBURGH AND CHICAGO
WORKS AT ALLEGHENY AND McKEES ROCKS, PA.

G. W. WRENSHALL,
General Manager.

McKees Rocks, Pa., February 23, 1923.

ALL AGREEMENTS ARE CONTINGENT UPON STRIKES, ACCIDENTS, FIRES AND OTHER DELAYS UNAVOIDABLE OR BEYOND OUR CONTROL

The Bonnot Company,

Canton, Ohio.

Gentlemen:-

With reference to the pulverized coal system which you installed for this company at its McKees Rocks Plant some years ago:

Would say that the installation is successful in operation and has been a very large saving to us in the cost of fuels for furnace heating, annealing of malleable castings in our foundry, etc., and we consider the system a decided success.

Yours very truly,
G. W. Wrenshall
General Manager.

C.M/s

Proved by Years of Service

"a decided success"

The Pressed Steel Car Company, McKees Rocks; Pennsylvania, builders of freight and passenger cars, unqualifiedly endorse Holbeck Pulverized Coal Systems after more than five years use.

Economical in operation, satisfactory in performing heating operations, effective in control, it "has been a very large saving in the costs of fuels."

These results can be secured in your plant.

PULVERIZED COAL EQUIPMENT

Write for Bulletin No. 600

The Bonnot Company, Canton, Ohio

Sole Licensees for Holbeck Systems in the United States

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STEEL GRIP
MADE IN CHICAGO



No. 644 Gauntlet Glove, reinforced with flexible steel ribbons clinched over strips of tough leather.

Extra leather patch on the thumb. $18.00 per dozen pairs.

Hand Insurance Means More Production

Insure against torn, bruised hands with Steel-Grip Industrial Gloves. They give the men added assurance of safety, and aid the management in eliminating lost time due to painful injuries.

Thin gloves and make-shift substitutes often do more harm than good.

Men who handle castings and other rough materials in shops, foundries, mills, scrap yards, mines or smelters require gloves especially made for the job.

STEEL-GRIP INDUSTRIAL GLOVES

are *built up* of three wearing surfaces and a comfortable felt lining—flexible steel ribbon reinforcement clinched over tough strips of leather and strong steel thread stitching. No danger of seams ripping, burning or tearing out.

There's a Steel-Grip glove to meet every industrial requirement.

Catalog sent on request.

INDUSTRIAL GLOVES CORP.
2647 Maplewood Ave., Chicago.

Try a dozen Pairs



No. 605 Short Glove, steel ribbon reinforcement and extra wearing patch in palm. $16.00 per dozen pairs.

(*Continued from page 39*)

babbitt and fins are removed from the bearings by means of a high speed milling cutter mounted on a horizontal arbor.

Leaving the trimming machines the cylinders pass, via conveyor, a peening operation shown in Fig. 24. Here the babbitt is compacted by special corrugated hammer heads operated by air.

Among the final machining operations on the Ford motor cylinder blocks is that of finishing the cylinder bore. This is rolled to size instead of being reamed or ground, a practice which originated at the Ford plants. The tool used for this rolling or swaging operation is shown in Fig. 26. It consists of a tool head in which are mounted hardened and ground rollers, held to exact diameter and free to rotate. In passing these tools through the cylinder bore the diameter is increased approximately 1/1000 of an inch and the metal, besides being compacted, obtains an exceedingly smooth finish.

After the machining operations are completed the cylinders pass through a washing machine shown in Fig. 27, where the oil and grease which may have been accumulated by them during the machining operations is removed. The final operations on the cylinder blocks are shown in Fig. 28. The operator at the left is blowing out the port cavities by means of a compressed air device. The remaining men shown in this picture are inspectors who are checking up the various machined dimensions. This inspection takes place on one side of a loop conveyor and on the move. At the end of this conveyor are situated the hydraulic testing machines previously shown in Fig. 11. All cylinders which satisfactorily stand up under this final water test are marked O. K. and are slid out upon the finished stock conveyors to begin their journey to the shipping platform.

The remaining pictures presented with this article have to do with tractor piston maching. These operations have been selected as representing Ford machining practice applied to small castings as contrasted to the heavier work represented by tractor and car cylinders.

DODGE

Material Handling Equipment



This Dodge conveyer helped build the Mitchell Dam at Verbena, Alabama

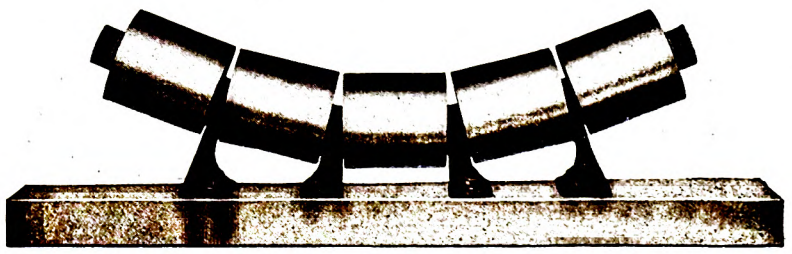
THE 30 inch belt conveyors shown above run from the recrushers to the storage pile and handle 2 inch rock continuously at the rate of 100 tons per hour.

Another conveyor using a 36 inch belt handles 6 to 8 inch rock from sledging crusher to recrusher house at the rate of 200 tons per hour.

Dodge conveying equipment embodies the qualities of sturdiness and fitness for the job which assures steady uninterrupted handling of materials at minimum expense for repair and upkeep.

Our engineering department is qualified by long experience to recommend the right installation to most economically serve your specific purpose.

Write for full particulars about the standardized Dodge line of conveying and elevating equipment.

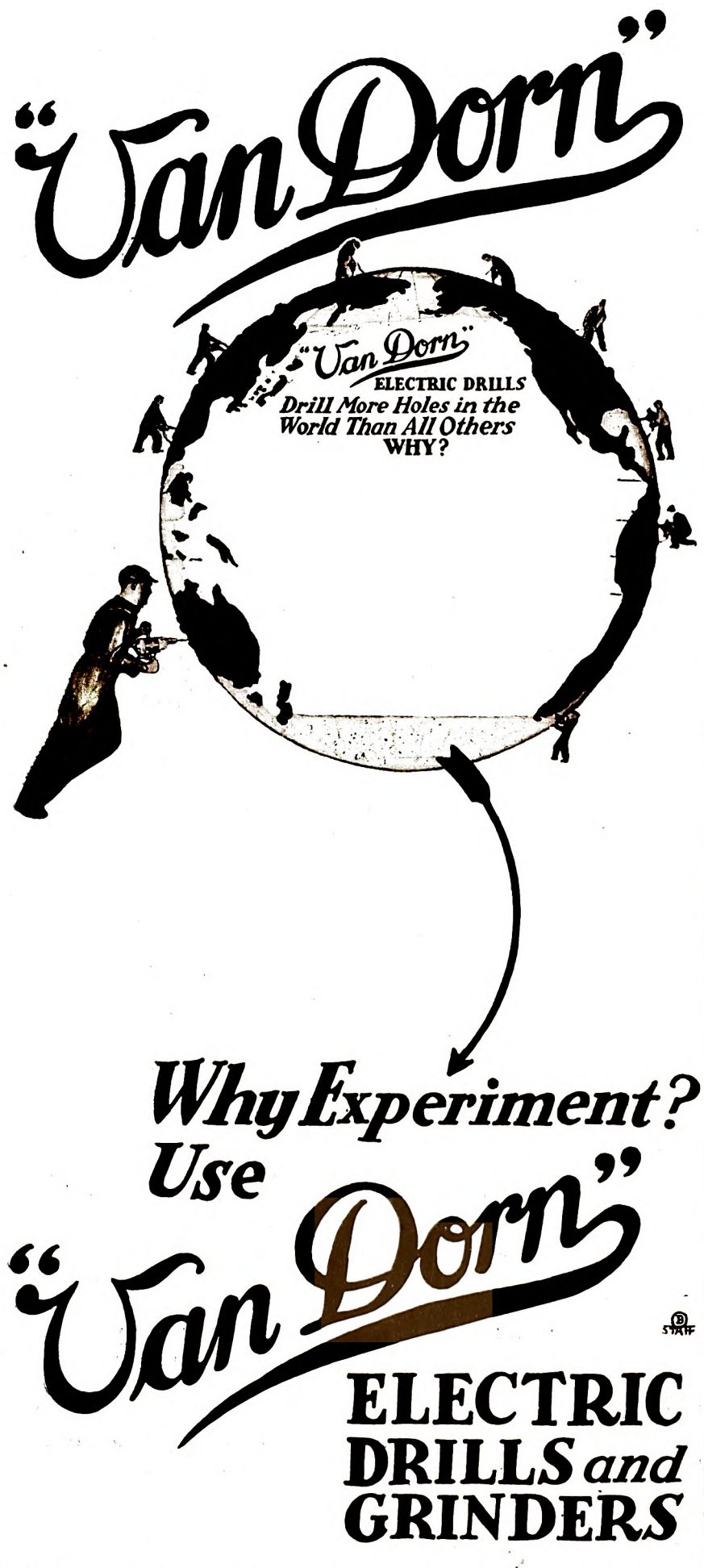


Dodge Manufacturing Corporation

General Offices: Mishawaka, Indiana. Works: Mishawaka, Indiana, and Oneida, N. Y.
Dodge Manufacturing Company of Canada, Ltd., Tronto and Montreal

New York, Boston, Philadelphia, Pittsburgh, Atlanta, Cincinnati, Minneapolis, Houston, Seattle, St. Louis, Chicago, San Francisco

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Why Experiment?
Use
"Van Dorn"
ELECTRIC DRILLS *and* GRINDERS

They are invariably selected for the real "He-Man" drilling jobs.

If you need a drill that will drill, or a grinder that will grind continuously—

Let us send you our catalog.

The Van Dorn Electric Tool Co.
Cleveland, ***Ohio***

What Cooper Union Means in the Engineering World

(*Continued from page 30*)

processes; John P. Leo, chairman of the Board of Standards and Appeals, Greater New York; Frederick T. Crane, City Engineer, Orange, N. J.; Charles F. Giraud, civil engineer New York Central and Hudson River R. R.; Adolph G. Koenig, engineering contractor power plants, and many another man of like importance. You will find Cooper Union engineers in all the important departments of Greater New York; in Government ordnance works; in Edison and other electrical plants; professors of engineering in many universities, from E. J. Kunze, of the Pennsylvania State College, to Robert M. Storme, at Tientsin, China, a long way from the old brown structure in Cooper Square.

The very fact that Cooper Union pupils work at some vocation while pursuing their studies, accounts for the earnest type of students to be found in its classrooms and the prominence which its graduates attain in the three branches of engineering taught. Then, too, the practical application, during the day, of theories learned at night, makes the engineering course at Cooper Union peculiarly intensive.

The part that Cooper Union plays in the engineering world of this country may not be over-estimated. It is, therefore, a noteworthy fact that this branch of its activities recently formed an organization known as the Cooper Union Branch of the American Society of Mechanical Engineers, which supplies that connecting link between the embryo and professional engineer by means of which the student is put in touch with the practical operations of his profession and given opportunity to see and hear the achievements of the greatest engineers this country affords.

Mr. Calvin W. Rice, Secretary of the American Society of Mechanical Engineers, and other distinguished members of the profession, went to the students' meeting at Cooper Union to welcome the new body into professional folds and uttered the highest encomiums upon the number and enthusiasm of the students and the manner in which they conducted and presided over the meeting. Officers of this new organization in the engineering life of New York, are: Harold W. Merritt, chairman; Samuel Wilnin, vice-chairman; Goodman J. Harris, Secretary, and Israel H. Marantz, treasurer.

Membership in this student branch is limited to men in the last two years of the mechanical engineering course, and the fact that day-school men average twenty, and night-school, twenty-three years in age, created a peculiar condition and made it necessary to satisfy the requirements arising from such a state.

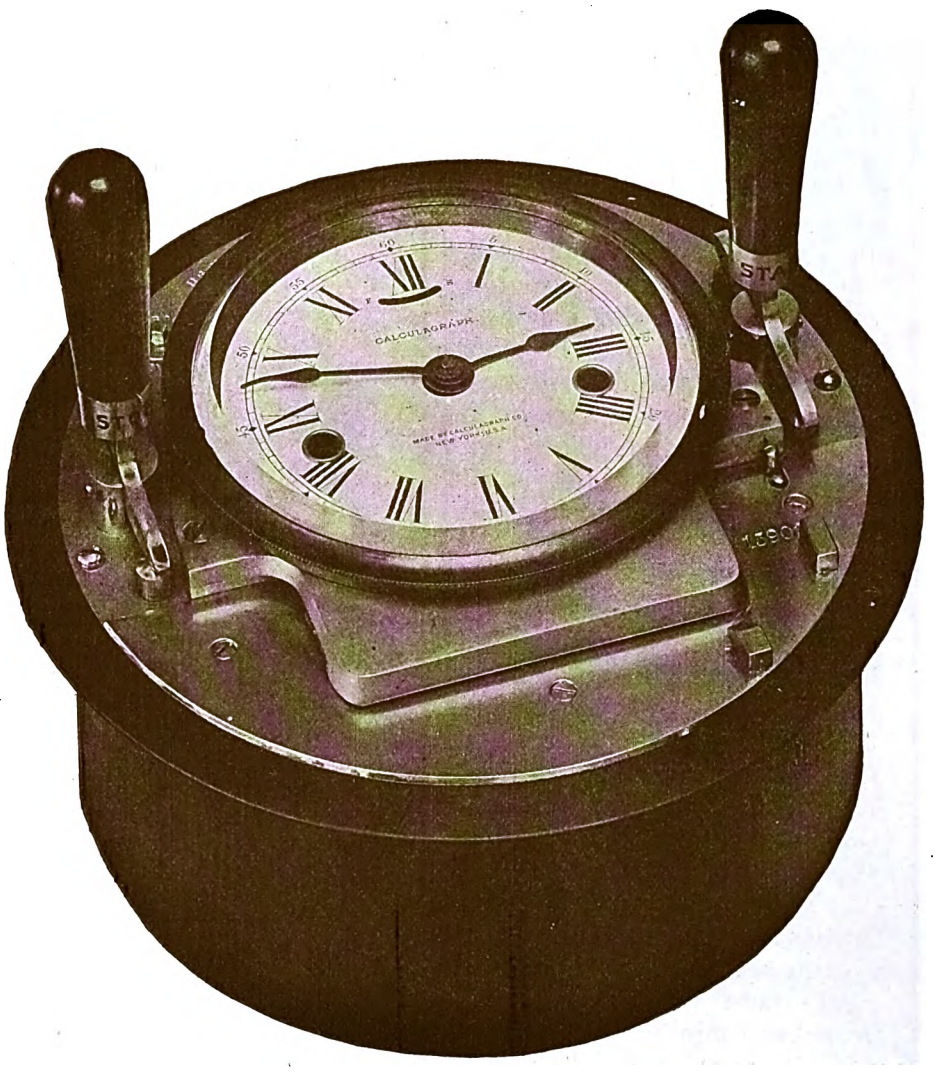
There are only about four such engineering schools in the United States, with not sufficient similarity in their day and night classes for complete education in engineering to afford a precedent, and the society of professional engineers suggested that the Cooper Union student body model its organization according to requirements, since the parent society is liberal as to the form of constitution they draw up.

Cooper Union is, perhaps, the most efficient "melting pot" New York owns in its process of Americanizing foreign born citizens. Numbers of its earnest and gifted students cannot speak a word of our language. Therefore, members of the newly-formed engineering organization include some foreign-born and some of foreign parentage although a majority of the sixty-five students enrolled are Americans.

Of their own initiative these embryo engineers applied to the American Society of Mechanical Engineers for authorization in the forming of a student branch. When this was granted, Professor George F. Bateman, of the Engineering Department of Cooper Union and himself a graduate of that institution, assisted the young men to form a committee and after a constitution had

(*Continued on page 44*)

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Can you afford a yearly production loss of $2,250?

If you have 100 men in your shop averaging 30c an hour, and each of them computes his own time for every job, you will find that it takes each one about 15 minutes a day to calculate the elapsed time.

Fifteen minutes is not much. But, if you will stop to figure the total cost to you over a period of one year, you will find that you are losing $2,250.

Can you afford it?

The Calculagraph eliminates this loss—turns the wasted minutes into productive time. But besides that, the Calculagraph gives you an accurate printed record of the starting, finishing and ***elapsed time.***

Two pulls of the handles and the ***elapsed time*** is stamped right on the job ticket —the record is complete.

If you haven't seen our booklet "Elapsed Time Records," write for it today.

THE

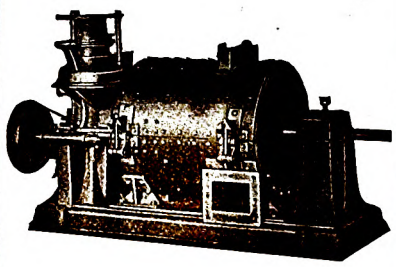
CALCULAGRAPH

THE ELAPSED TIME RECORDER

34 Church Street, New York City

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Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY
165 Broadway
New York

(Continued from page 42)

been drawn up it was adopted and given 100 per cent. enrollment.

Few know that students of engineering who are accepted in student bodies of professional engineering societies must qualify for this privilege by possessing high-school training, or its equivalent; and must be members of classes in engineering which have already given them a four years' course in that science and which would lead to an engineer's degree.

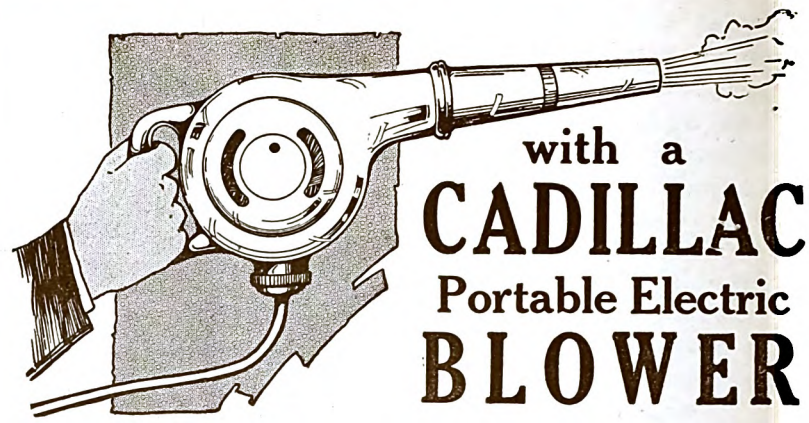
Cooper Institute teaches the main branches of engineering, and the four principal organizations which represent such training, professionally, are the American Institute of Electrical Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers, and American Society of Civil Engineers.

Of these four engineering branches, mining is omitted from the curriculum of Cooper Union, although a student's course in other forms of engineering, geology, chemistry and metallurgy form an excellent foundation for future studies along the line of mining endeavors.

It becomes evident that while a student of engineering receives, in his classes, a knowledge of those fundamentals necessary to the practice of his profession, he is out of contact with engineering professionally. This want the student branch of professional organizations supplies. Parent engineering societies care for the professional engineer; student branches of these societies provide for the professional engineer in embryo, before he graduates, and make the change from classroom to the practical application of its precepts less marked after the student obtains his degree.

One advantage possessed by student branches is that parent organizations furnish their very best men to speak to students. These, in turn, have an opportunity to deliver addresses on what they have learned, and, while imparting knowledge to others and increasing their own, become versed in the art of public speaking and acquire poise and self-confidence. They also

BLOW OUT THE DUST



with a
CADILLAC
Portable Electric
BLOWER

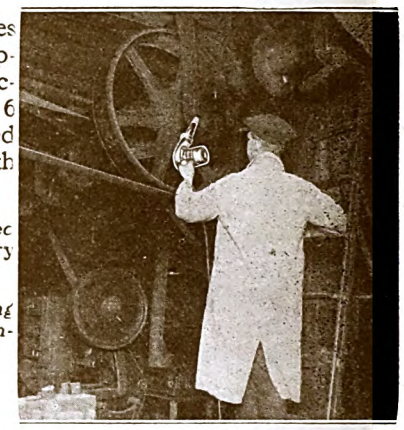
Blows dust out of motors, generators, machinery, line-shafting, stock-bins, shelves, etc. Lowers fire risk, eliminates needless waste of power in machinery by cutting down friction, and creates more healthful working conditions.

A complete unit in itself. Requires no expensive installation equipment; operates directly from electric light socket. Weighs only 6 pounds and may be carried and used anywhere. No condensation as with compressed air.

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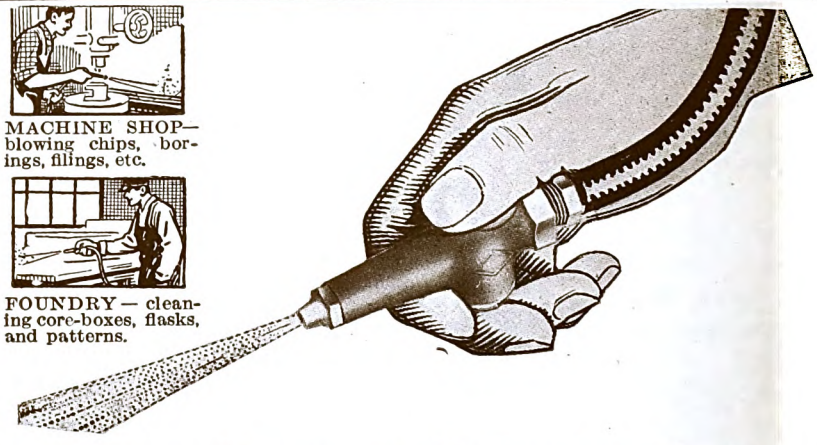
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MACHINE SHOP—blowing chips, borings, filings, etc.

FOUNDRY—cleaning core-boxes, flasks, and patterns.





TEXTILE MILLS—blowing lint, dust, and dirt from machines.



ELECTRICAL STATIONS—cleaning armatures, field coils, boards, and controllers.

Users of Compressed Air!

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Fitted with a Jenkins Renewable Disc specially made for air, Jenkins Air Gun holds tight when closed and stops air waste.

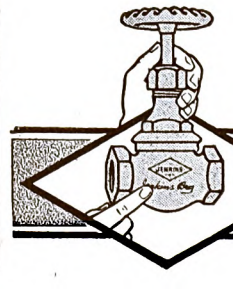
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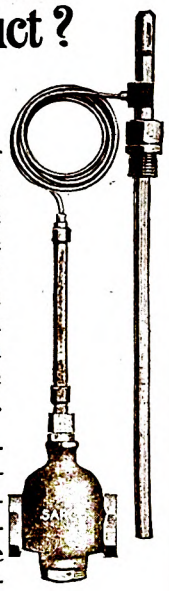
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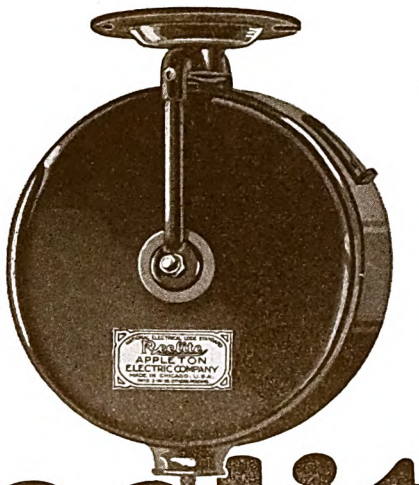
may, after listening to addresses by great engineers in the parent societies, make resumés of these papers for the benefit of fellow students. Since student branches meet frequently, their opportunities for receiving and disseminating knowledge are considerable.

Cooper Union gives sound instruction in the fundamentals of engineering and a three months' vacation to students, who need no urging to adopt the suggestion that they take up work in line with their profession—since work they must—and recount their experiences and observations during vacation to their fellows.

The students' branch provides for visits to various engineering points of interest, and on such occasions students are left to develop their own initiative. Some member of the faculty sits on the Governing Board of student branches, but merely to act as advisor in case problems arise that require his aid. On their visits to engineering plants, students are without instructors, except as guests. All the instruction given is furnished by a guide at the point visited.

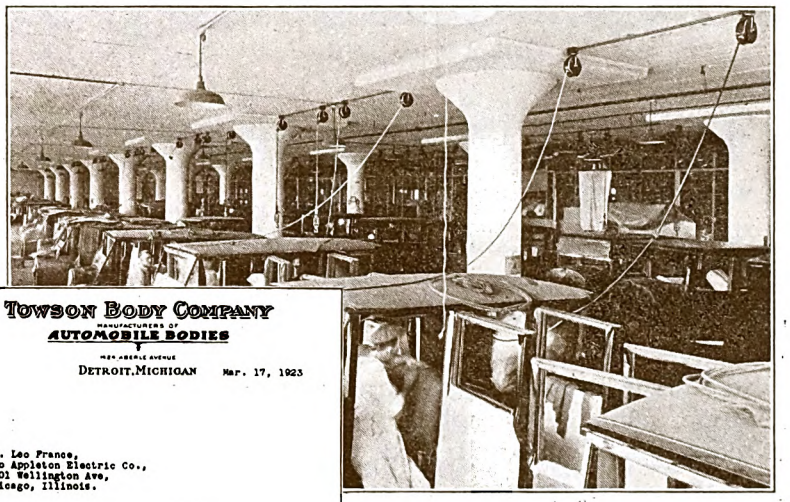
From its inception the Cooper Union Students' Branch of the American Society of Mechanical Engineers, decided that theirs should be a professional, not a social organization. They know that their work will be criticized by experienced engineers and that they must reply to this criticism by explaining the principle on which they had worked out the problem presented. They realize to the full, what it means to their professional future to have the benefit of such criticism and coöperation in their student days.

Not only have they adopted the watchword—"Service"—of the American Society of Mechanical Engineers, but they speak of and act on it in their society and seek to convey in their actions how thoroughly hey intend to apply this motto: "Service to others is the expression of the highest motive to which men can respond, and duty to contribute to the public welfare demands the best efforts that men can put forth."



Reelite

REG. U.S. PAT. OFF.



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MANUFACTURERS OF
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DETROIT, MICHIGAN Mar. 17, 1923

Mr. Leo France,
c/o Appleton Electric Co.,
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Chicago, Illinois.

Gentlemen:

Replying to your inquiry of Mar. 15th regarding your #1525 Reelites, we wish to advise that at the present time we have about 350 in use. These reelites show a tremendous saving over the old style drop cord in that they are easily removed from the paths of moving trucks.

Prior to our installation of this equipment it was necessary for us to constantly replace the old cords due to the fact that they were being cut to pieces by trucks.

We are willing to recommend these as a good investment both as time savers and also as a reducer of maintenance expenditures.

Very truly,
TOWSON BODY COMPANY.
A.H. Brake
Asst. Purchasing Agent.

AHD:Q

Cutting the Cost of Cord Maintenance

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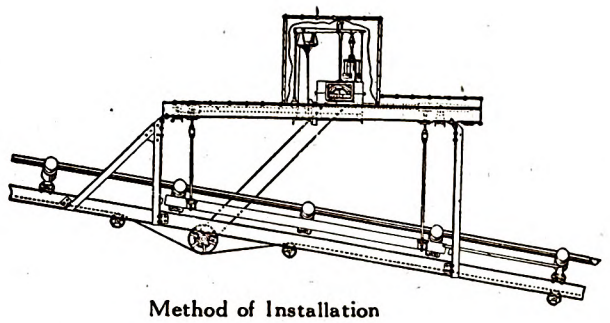
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Method of Installation

THE Merrick Weightometer provides an accurate means of checking conveyor handled material while these products are in transit.

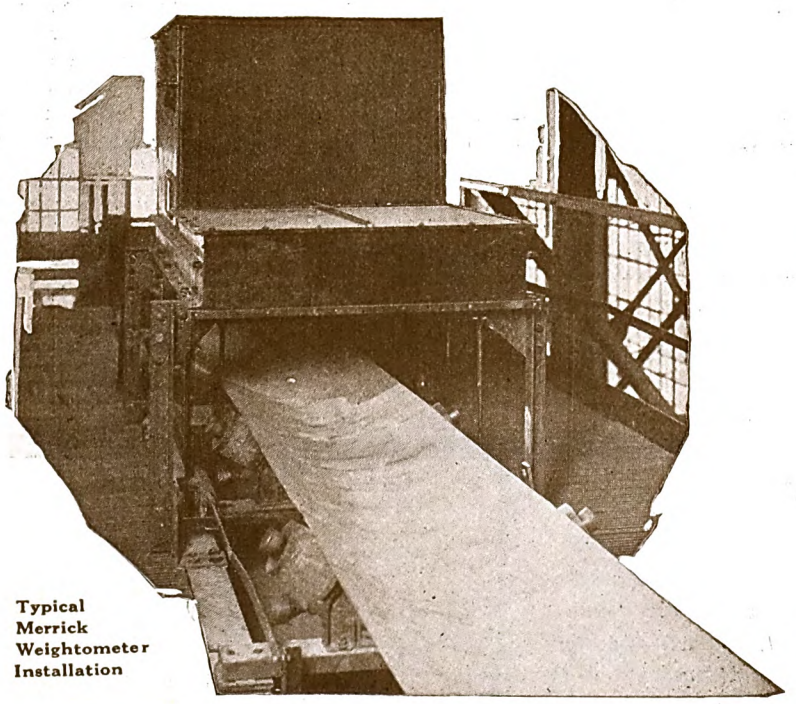
No additional handling is necessary—no added costs in time and labor—no weighman or attendant is needed. And the accuracy is guaranteed 99 %.

It gives reliable weights on all materials bought and sold. It is adaptable to the weighing of coal, gravel, stone, cement, phosphate, fertilizer, fish, ores and many other bulk materials.

Reliance on Bill of Lading weights is far from dependable.

Let us explain to you the advantages of the Merrick Weightometer. Write for the "Merrick Circulars." They will show you a way to added profits that you have probably overlooked. ***Send in for them Now.***

MERRICK SCALE MFG., CO.,
180 Autumn St. Passaic, N. J.



Typical Merrick Weightometer Installation

Promoting Team Work Through Athletics

(*Continued from page 21*)

baker plants was 23.7 per cent., while the average for other factories in Detroit in the same month was 26.4 per cent. The corresponding month of 1921—in the midst of the business depression—showed the Studebaker turnover to be 3.3 per cent. and the average for the city to be 12.1 per cent., while May of 1922 shows a turnover of 10.8 per cent. in the Studebaker organization as compared with a city average of 19.2 per cent.

Making the same comparison for the month of June of each of these three years we find that the Studebaker turnover in 1920 was 23 per cent. and that of the city was 25.9 per cent.; in 1921 it was 4.2 per cent. in the Studebaker plants and 14.7 per cent. in other factories throughout the city; and in 1922 it was 15.9 per cent. for Studebaker as compared with 21.5 per cent. for the city average.

The "Length of Service Report," reproduced herewith, gives another view of the subject. Reading from top to bottom, the lines represent respectively, the total working force, the number who have been in the service more than one year, and so on for two, three, four, and five years. This merely affords another illustration of the fact that employees of the Studebaker Corporation are sticking with their jobs.

These are tangible results that can be listed and analyzed. There are others that can be appreciated only by one who has visited the Studebaker plants and watched the men at their work; one who is familiar with the mechanical, stolid, listless, resentful, gloomy, disinterested attitude of employees in many factories and who compares this with the exuberant joy of living manifested by the Studebaker workmen. They radiate an atmosphere of good cheer and animated interest. At odd moments they are seen to be bantering one another. They always have something to say as they pass one another in their work, and what they say must be pleasant, for there are many grins and jovial expressions. And then when the lunch hour comes or the day's work is done, they start playing!

It is to this very playing that executives of the corporation attribute much of their success in reducing labor turnover, increasing production, and promoting contentment and good will among the men. There are of course other factors, such as the anniversary check plan, the stock purchase plan, the vacation plan and pensions and life insurance plan—all features of the Studebaker Coöperative system, which was inaugurated September 1, 1919, and which is now well known—but it is doubtful whether any of these have been quite so successful in bringing about the favorable results listed above as has the promotion of athletics in the organization.

Perhaps no other industrial organization in the country has so many employees actually participating in some form of athletic sport. To list the games and contests in which Studebaker teams are active is almost equivalent to cataloguing American outdoor and indoor sports. Major and minor executives, skilled and unskilled workmen, clerks and stenographers, both men and women, engage in practically every known form of athletics, not even omitting checkers. So comprehensive is the athletic program of this corporation, in fact, that its employees participate in sports practically every day or evening of the year.

Take bowling, for example. The Studebaker-Detroit plants boast six leagues, aggregating fifty-four teams, composed of several hundred players, in this one sport alone. By way of comparison it is interesting to know that no other plant in the city has more than 16 bowling teams. The Studebaker girls alone have six teams. In addition to inter-plant contests in Detroit, the Studebakers engage in inter-city contests with teams from the South Bend

(*Continued on page 48*)

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The Caldwell Steel Tank is like our other products in that it reflects all the excellence of character that such experience produces. You can rely upon it for unusual performance.

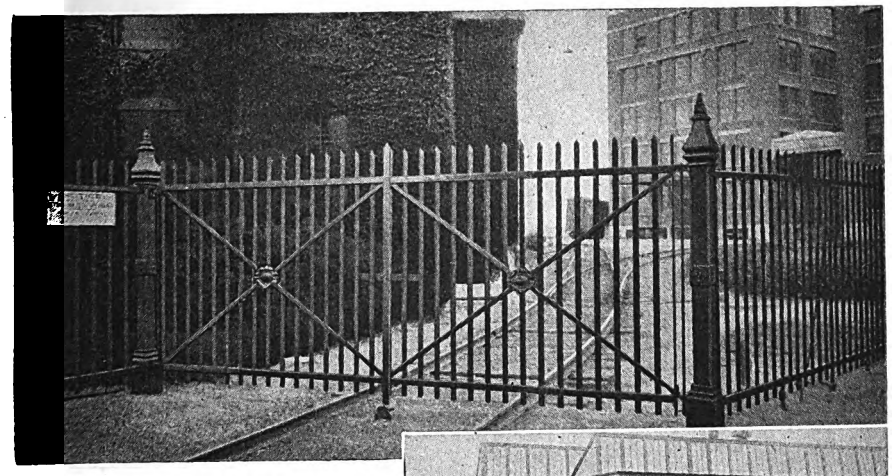
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Caldwell TANKS AND TOWERS



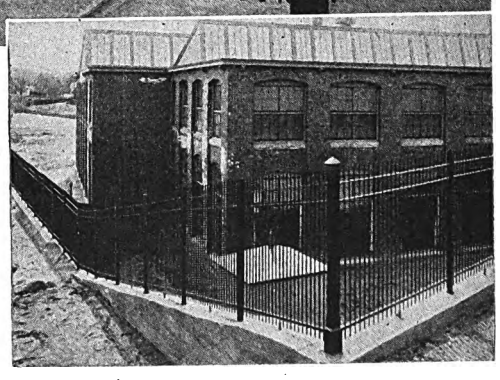
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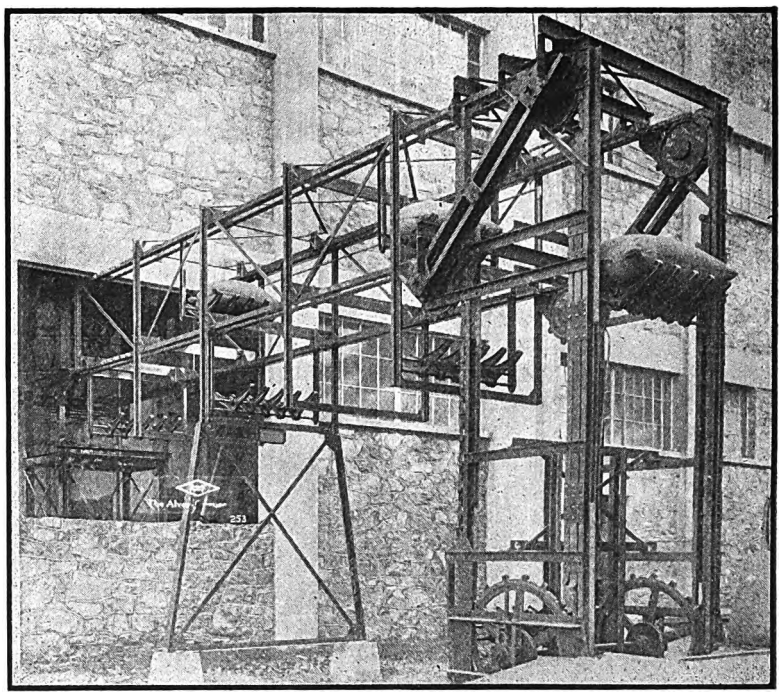
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From platform to top floor—with one handling

Just such difficult handling problems as this are best solved by installing Alvey-Ferguson Conveyors. The Hershey Chocolate Company storeroom is five floors above the loading platform. This A≡F Vertical Elevator carries the bagged cocoa beans from the platform into the building and up to the top floor where they are unloaded automatically. The only manual labor required is loading the bags at the platform. A 7½ H. P. motor operates the entire conveyor. An enormous saving over the truck and elevator way of handling.

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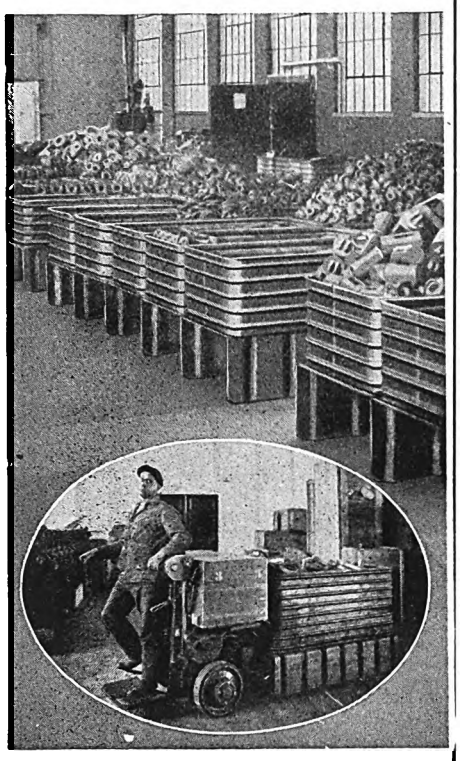
Your plant, no doubt, often presents some such handling problem as this. No matter how out-of-the-ordinary it may be, you can put an A≡F conveyor on the job at a saving of time and expense. A≡F Vertical Elevators are designed and built for individual requirements such as yours. Where standard machines are not practical, our Engineering Department will design a special conveying system to suit your needs. Consult us on your handling. Write today.

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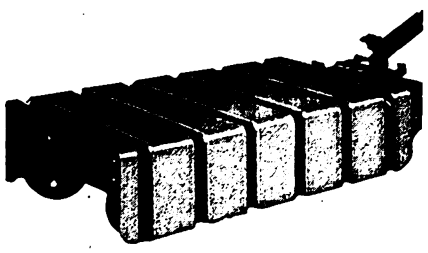
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Skeleton boxes fitting any size platforms are furnished in various depths. They are either welded securely to the platform or equipped with steel stakes which slide into the ribs of the platform. Made of heavy gauge steel, reinforced with deep stiffening ribs and flanged edges. We make boxes to meet every requirement.

Tell Us Your Requirements for Anything in Pressed Steel Parts

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YOUNGSTOWN, OHIO

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(*Continued from page 46*)

plants and in industrial league contests with teams from other plants of Detroit. The Industrial Bowling League, composed of teams from thirty different industries in Detroit, was organized by H. D. Russel, recreational director for the Studebaker Corporation, and the Studebaker team always leads the league. It also defeats the South Bend team regularly in the annual contests, having won the championship each year that the games have been played. As this is being written, plans are being perfected for a championship contest between the different Studebaker plant leagues, for which the corporation is offering $250 in prizes.

"I have never seen anything to equal it in promoting a spirit of democracy and good fellowship," declares Mr. Russel, in speaking of the bowling teams. "Everybody bowls, from the superintendents to the office boys. The superintendent of this plant is manager of one of the leagues. Practically every foreman in the organization is an active member of one of the teams. And to show how democratic they are, one team is composed of a general foreman, a foreman, and three machine operators; and one of the machine operators is captain of the team."

Indoor baseball is another of the popular sports in which the Studebakers excel. Eighteen to twenty teams play at plant number three every day at noon. In championship contests the Studebaker team has won nine games and lost only one so far this season.

Some fourteen teams play baseball during the summer, though there has been some difficulty experienced in obtaining the use of playing diamonds in the city. The girls of each plant also have baseball teams and engage in interplant contests.

Basket ball is represented by a highly proficient team that engages representatives of other plants in the City Industrial league.

A standard shooting range has recently been established in one of the Studebaker-Detroit plants, conforming in every respect to the N. A. R. regulations, and it is expected that fifty or sixty members

(*Continued on page 50*)

EFFICIENT HEATING

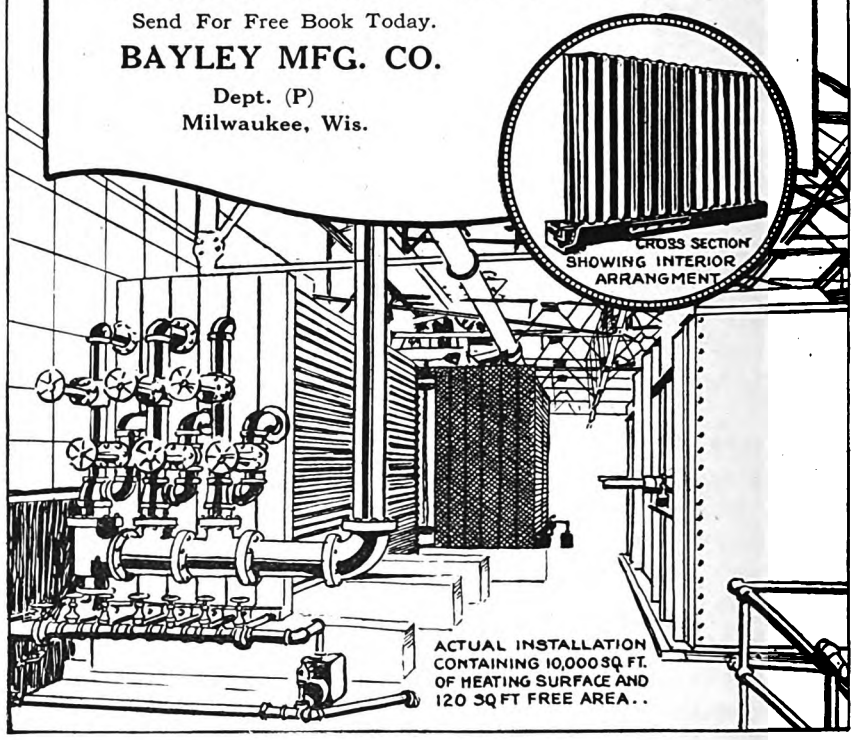
Demands Radiators so constructed that every square foot is prime heating surface.

Bayley CHINOOK HEATERS

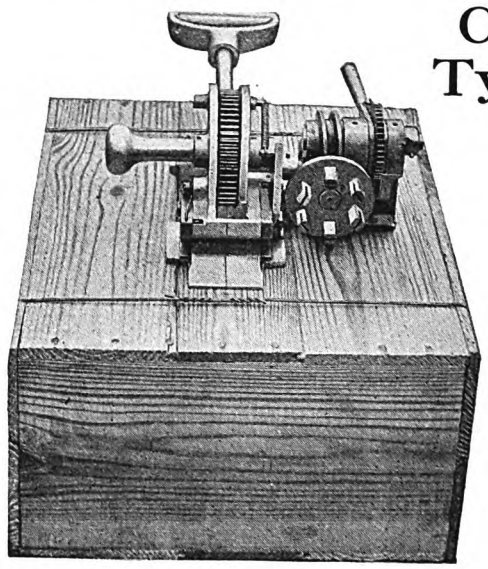
are built on the "tube-Within-A-Tube" principle, every tube a complete radiator in itself, free from water hammer, return bends, elbows and nipples. Any tube can be removed without interfering with any other tube. Can be shipped K. D.

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The sturdiest and most efficient machine ever devised for the application of wire bands at any desired tension to all kinds of boxes, crates, etc.

Simple but Positive

in operation. Fool-proof and built to stand hard service. Weighs only 14 pounds.

The manner in which the wire is automatically sealed insures maximum strength and leaves no sharp ends to protrude and cause damage.

CARY'S Capped Bundled Wire



The wire with the patented shoulder

The Only Perfect Wire for Use in any Wire Tying Machine

A special drawn round galvanized wire in 13 and 14 gauge. The 13 gauge wire is packed in bundles containing 250 pieces; 14 gauge, 400 pieces in a bundle. Furnished in any length desired.

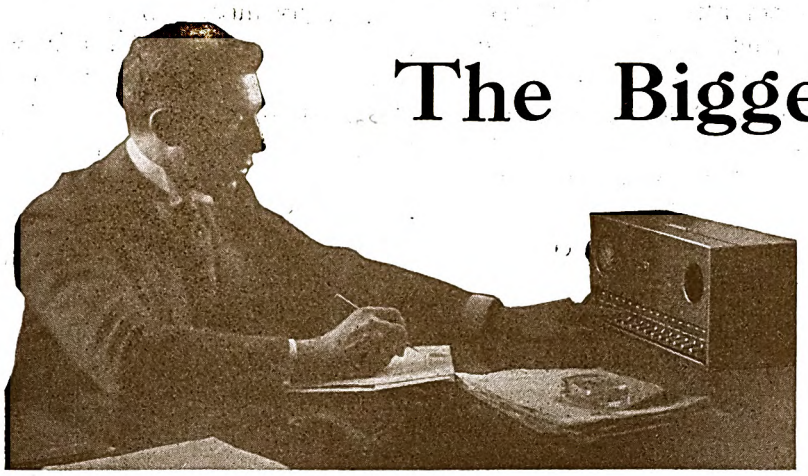
The patented shoulder holds the wire securely in any tying machine and absolutely prevents slipping. This is an exclusive feature.

Our method of bundling insures every wire being in perfect condition when received by you.

Prices and discounts furnished on application

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Let us prove by a ten minute demonstration on your desk that the Dictograph System will save in a year more than it costs. Write us for an appointment.

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(Continued from page 48)

will compose the newly organized "Studebaker Rifle and Revolver Club."

Other sports in which Studebaker employees are active are skating, swimming, track, boxing, wrestling, acrobatics, golf, horseshoe pitching and checkers. One evening each month they have the use of the Atkinson Community House, a civic community center affording a gymnasium and other facilities, and on these occasions from a thousand to fifteen hundred of them gather there for exhibitions and contests such as swimming, racing, boxing, wrestling, and jumping.

The Athletic Association of one of the Detroit plants conducts frequent noon-day meetings at which time the general welfare of the organization is discussed and prominent men are occasionally invited to speak. In the list of noted speakers are Edwin Denby, secretary of the navy; Senator-elect Ferris; Senator Townsend; Ralph O'Connor, author of "The Sky Pilot"; and James E. West, chief executive of the Boy Scouts of America.

The Studebaker employees are evidently musically inclined also, as they have two fifty-piece bands, a forty-piece orchestra, and numerous duets, quartetes, sextets, and octets, both instrumental and vocal. The musical organizations are frequently invited to play before very important assemblages, as well as for parades and patriotic demonstrations.

The annual picnic, held at one of the island parks near Detroit in August of each year, is the crowning event of all the Studebaker sports. Practically all employees attend, together with their families, and participate in games and contests of many kinds.

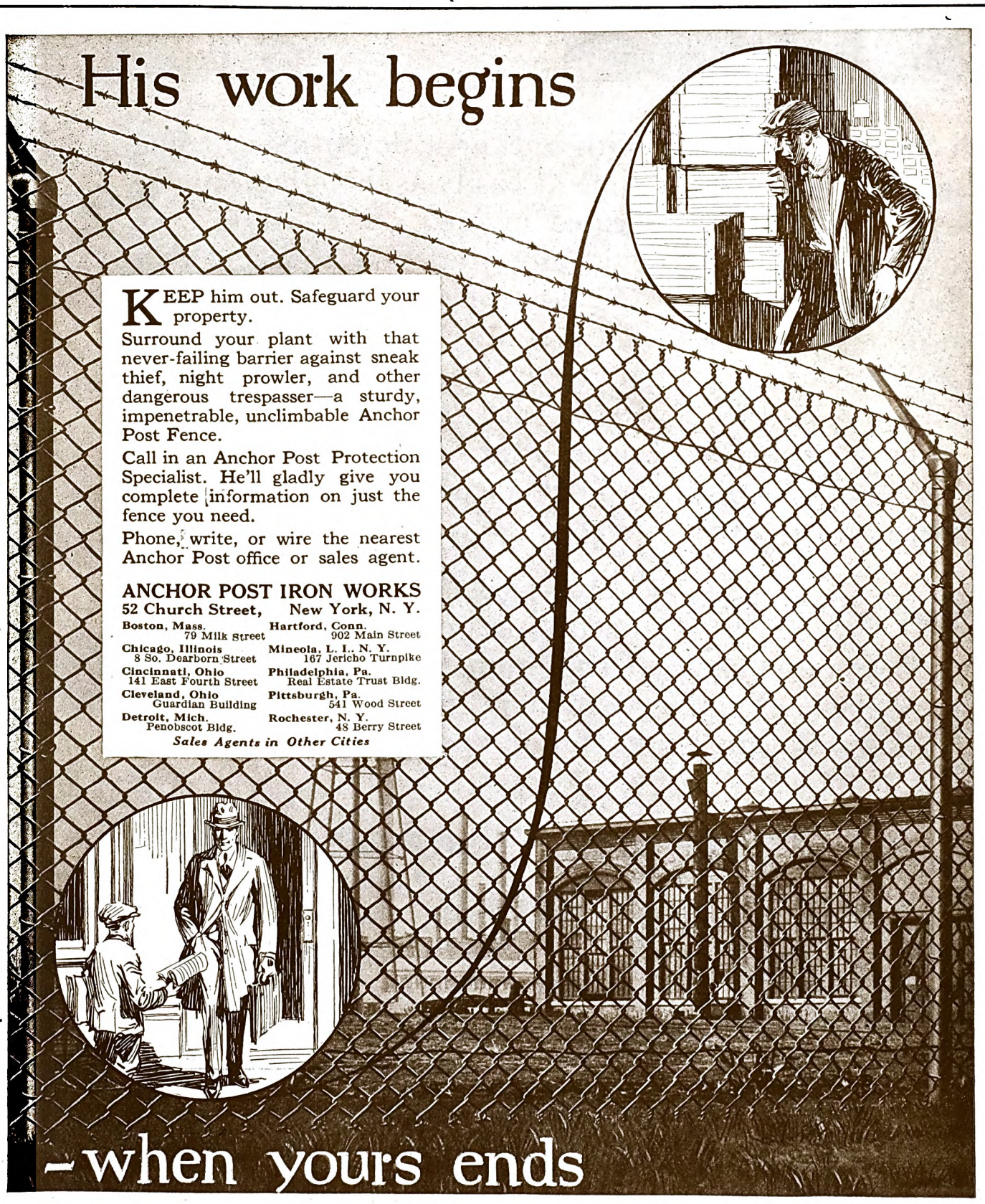
"Moonlights" on the lake and a winter frolic are fostered by an organization known as The Studebaker Manufacturing Club, and the proceeds are pooled for the benefit of Studebaker people who may need assistance. The frolic attains the proportions of an indoor circus and lasts for three evenings. Last year three automobiles, besides many lesser prizes, were given away in connection with this event and a large sum of money for the fund was realized.

Despite the enviable records which Studebaker athletic teams have earned, sports have in no sense been commercialized in this organization, every member of the teams being employed for the one purpose of building automobiles and not because he is a good athlete.

"The trouble with so many industrial athletic undertakings," asserts C. S. Slack, manager of the Coöperative Department, "is that they become obsessed by the desire to win at any cost, and in order to do so they employ professional players in some nominal position at a big salary. We have never employed any person for any purpose other than to build automobiles, or at least to assist in building them. Employing 'ringers' to play on the athletic teams destroys the very purpose of athletics in the organization.

"We always impress upon our employees the fact that our one job is to build automobiles. Whatever activity we may en-

(Continued on page 52)





FIRM—BECAUSE THEY ARE ANCHORED

Anchor Post Fences

PERMANENT—BECAUSE THEY ARE GALVANIZED

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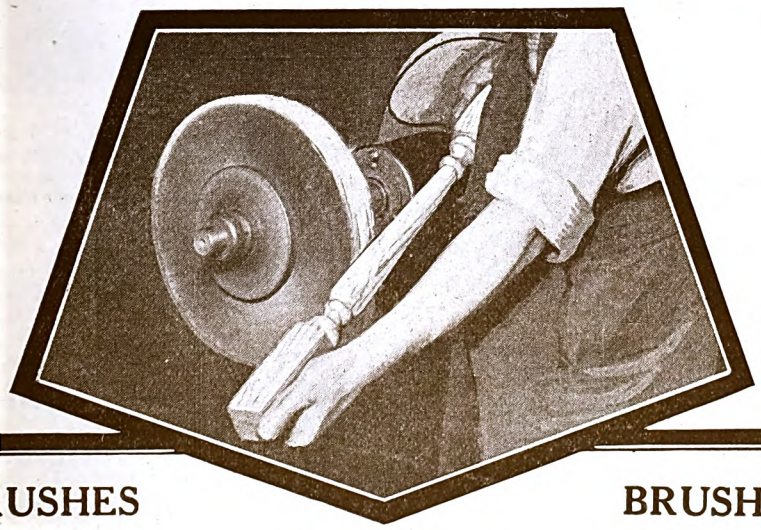
DIAGRAPH
YOUR SHIPMENTS

The Diagraph cuts legible address stencils for marking all packages, boxes, bags, cans crates, castings and similar material. Addresses do not blur, wash or rub off. Safer than tags. A practical insurance against lost and delayed shipments.

Try one free in your own shipping room—price complete with all supplies, only $110.00 delivered, in either housed or open models. Order one on trial—no obligation to buy—we pay all charges.

DIAGRAPH STENCIL MACHINE CORPORATION
1625 So. Kingshighway Blvd., St. Louis, Mo.
Branches in all principal cities. See phone books.





BRUSHES **BRUSHES**

OSBORN ROTARY BRUSHES are cleaning—

- —*gears.*
- —*castings.*
- —*flinted shanks of twist drills.*
- —*ships.*
- —*netting in coffee factories.*
- —*cans in canning factories.*
- —*moulds of all kinds.*
- —*auto springs, both before and after they are assembled.*
- —*compressed air tank plates.*
- —*threads on pipes after galvanizing.*
- —*carbon from boiler caps.*
- —*metal parts after welding.*
- —*structural iron work.*
- —*tire carcass before retreading.*
- —*scale from hot or cold forgings, tools, shovels, axles.*
- —*brass or copper parts before brazing or plating.*
- —*brass or copper tubing before polishing.*

THE question isn't "*Do you* use rotary brushes?" It is "*Can you* use rotary brushes?" The Osborn Brush-Engineering Department is here to answer that question whenever you suggest—this week, if you say so.

Brush Division of
THE OSBORN MANUFACTURING COMPANY
INCORPORATED
New York CLEVELAND Detroit
Chicago San Francisco

OSBORN



The founders of this business are looking for jobs

TWO YEARS AGO the members of the sales department of a manufacturing concern whose product sold faster than it could be made resigned in a body to build a competing plant. All the money they had or could borrow went into machinery and equipment.

For a while the plant was a beehive of Industry. The company introduced to the market a good product at a substantially lower price, and it sold readily.

Today that factory is closed

The equipment will be sold at auction to satisfy debts. And most of the men who founded the business are idle, their savings gone, their assets pledged to creditors.

The magazine "Sales Management," commenting on the tragic incident, says;

> "It is the story of every concern that ever started in business with the idea that selling was all there was to business. It is just such calamities as this that prompt us to repeat what we have so often preached—sales managers must study the big, broad phases of business. Make it your business to know the problems of the production man, the credit man, the purchasing agent, and last but not least, the financing of the business. . . There has to be some head to every business, and that head must be able to see all sides of the problem."

You could hardly compress into one paragraph a better reason for the Alexander Hamilton Institute. It was founded by a group of business leaders who recognized that business makes specialists—but does *not* develop all-round executives. The vital way in which the Institute meets this situation is illustrated by another story.

This man succeeded

For fourteen years R. Lee Smith was a sales manager, with an ambition to have a business of his own. "But my work gave me no understanding of business other than that which concerned selling," he wrote to the Institute. "I knew nothing of production, financing or business promotion."

Instead of setting forth unprepared, Mr. Smith clipped a coupon from an advertisement like this. He received and read "Forging Ahead in Business" and enrolled for the Modern Business Course and Service. With this sound foundation he organized the United Soda Fountain Company, which in only three years has become one of the leaders in its industry.

Problems of production, financing, accounting, advertising, credits, did not come to him as new and unfamiliar. "Your Course and Service gave me an understanding of these things," he writes.

This is not an isolated instance. More than 200,000 business men have shared Mr. Smith's experience. They were executives, salesmen, accountants, engineers, lawyers, bankers, factory and office men. The Institute did not make them better specialists in the one department of business where their experience had been gained. It added to that a working knowledge of all other departments, with results, in progress and income, testified to by thousands of letters voluntarily written.

Send for the book they sent for

These men gained their first knowledge of the Institute thru "Forging Ahead in Business," a book which contains *all* the facts about the institute. Will you give it an hour in exchange for what it may give you in vision and in counsel? It will be cheerfully sent on this condition.

Alexander Hamilton Institute
776 Astor Place, New York City

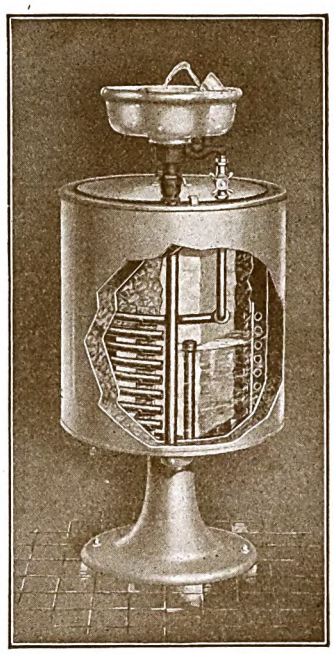
Send me "Forging Ahead in Business" which I may keep without obligation.

Name .....
Print here
Business Address .....
.....
Business Position .....

Canadian Address. C.P.R. Building, Toronto; Australian Address, 42 Hunter St., Sydney

Copyright, 1923, Alexander Hamilton Institute

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570. A.

The automatic control maintains a uniform height of stream— *regardless of pressure*

HALSEY TAYLOR Cooler Fountains are never out of order, or the stream low and unsanitary, when the line pressure is down.

Automatic control keeps the stream at uniform height and the patented two-stream projector converges two streams of water with a retarding action at the apex of the arch forming a convenient drinking mound.

These are two of the reasons why HALSEY TAYLOR Fountains are recognized as more efficient by manufacturers everywhere.

More than a score of corporations have 100 or more HALSEY TAYLOR Fountains in daily use, and are constantly adding more.

Write today for 32-page catalog of new fixtures for every drinking requirement.

The Halsey W. Taylor Company
529 North Park Ave.
Warren, Ohio

BRANCHES

NEW YORK CITY
137 E. 43rd Street
PHILADELPHIA
5224 Greene Street
BOSTON
46 Cornhill—Room 512
ATLANTA
222 N. Jackson St.
CHICAGO
1702 N. Talman Ave.
KANSAS CITY
202 Baltimore Bldg.
SAN FRANCISCO
237 Rialto Bldg.
DENVER
401 Jackson Bldg.

HALSEY TAYLOR

(*Continued from page 50*)

gage in must have this as its ultimate goal. On the other hand, anything that furthers this purpose receives our hearty support. We don't pretend to be philanthropists; we are merely coöperating for the common welfare of us all."

Mr. Slack brought forth a monthly record of employment, labor turnover, turnover in other industries, and production, and pointed out some of the more remarkable figures.

"There's the answer to your questions as to whether athletics reduce labor turnover and increase production," he said.

"There can be no doubt of the value of athletics in an industrial organization. You know the old proverb, 'All work and no play makes Jack a dull boy.' Sports give the workmen something other than the necessity of earning a livelihood to think of. They afford recreation and add a spice to his life that otherwise would be lacking. They promote team work, democracy, and good fellowship. They make better workmen because they make the workmen more cheerful, more contented, and more efficient. And better workmen produce more products. We foster and encourage athletics for everyone, from the highest executives to the most humble workman, because we know we all need to get out and play occasionally. Personally, I enjoy bowling very much. I haven't missed but once this year, and I wouldn't have missed then if I hadn't been out of the city." Opening his desk drawer and bringing out a box of cartridges, he went on: "We have just organized a rifle and revolver club and I have become a member. Here are my cartridges, all ready to get out and shoot. It's good sport and it is well for one to know how to shoot, anyway."

Questioned as to whether the intermingling of workmen and executives has a tendency to interfere with morale, Mr. Slack said that it does not; that as a rule the leagues are composed of players in the same or nearly the same class and that no unpleasant features had ever arisen. The fact that a machine operator may bowl against his foreman,

(*Continued on page 54*)



162 Tons of Coal saved per year

Quantities of fuel consumed in combustion never become productive. Heat is generated, but all of it is not utilized. From every surface there is constant heat radiation,—a source of unnecessary waste.

SIL-O-CEL
PREVENTS HEAT PENETRATION
TRADE MARK REGISTERED U.S. PATENT OFFICE
A CELITE PRODUCT

Sil-O-Cel Insulation forms a barrier to heat leakage, and in stopping this loss saves fuel. Take for example, an ordinary 500 H.P. Boiler. The fuel savings accomplished by installing a course of Sil-O-Cel Insulating Brick through the walls and over the tops of such a boiler will average 162 tons of coal saved per year. Savings are proportionate with other fuels—and in kilns, ovens, furnaces, oil stills, etc., the savings are even greater.



The facts regarding Sil-O-Cel show it to possess lower conductivity than any other insulation and adapted to all types of equipment without change in design:

Insulating Value—Powder 0.30; Brick 0.58 B. t. u. per sq. ft. per hr. per inch thickness per degree F. difference in temperature (U. S. Bureau of Standards), or one-tenth as conductive as firebrick inch for inch.

Resistance to Direct Heat—Brick and Powder 1600°F.; C-22 Brick 2200°F. without shrinkage.

Melting Point—2930°F. (1610°C.) U. S. Bureau of Standards.

Weight—Powder 15 lbs. per cu. ft. packed in place; Brick 1¾ lbs. each, equivalent to about 30 lbs. per cu. ft.

Crushing Strength—28 tons per sq. ft.

Forms—Brick, Block, Powder, Cement.

A request will bring Bulletin W-6C containing complete information. Use the coupon or write nearest office.

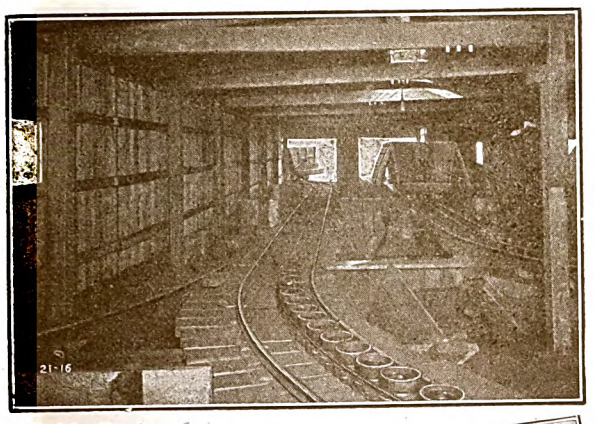
Celite Products Company
New York 11 Broadway-Chicago 53 W. Jackson Blvd.
San Francisco Monadnock Bldg.
Offices and Warehouses in Principal Cities
CELITE PRODUCTS LIMITED
New Birks Bldg., Montreal, Canada

Celite Products Company,
Gentlemen: We are interested in stopping heat waste. Send Bulletin W-6C describing the application of Sil-O-Cel Insulation, and tell us what it has saved in the following equipment:

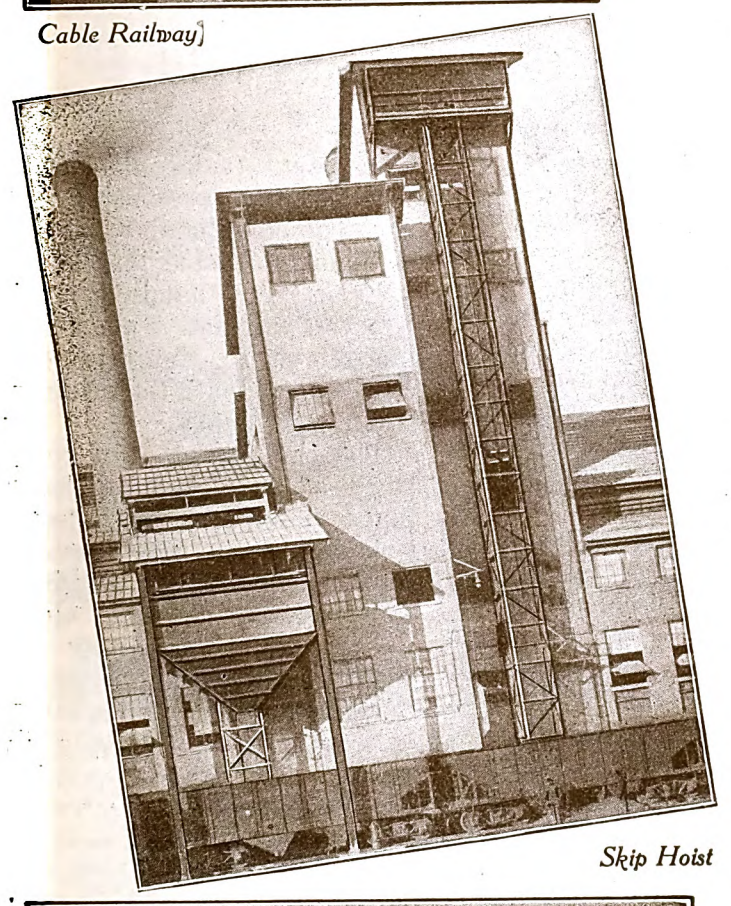
Type of equipment .....
Name .....
Company .....
Address .....

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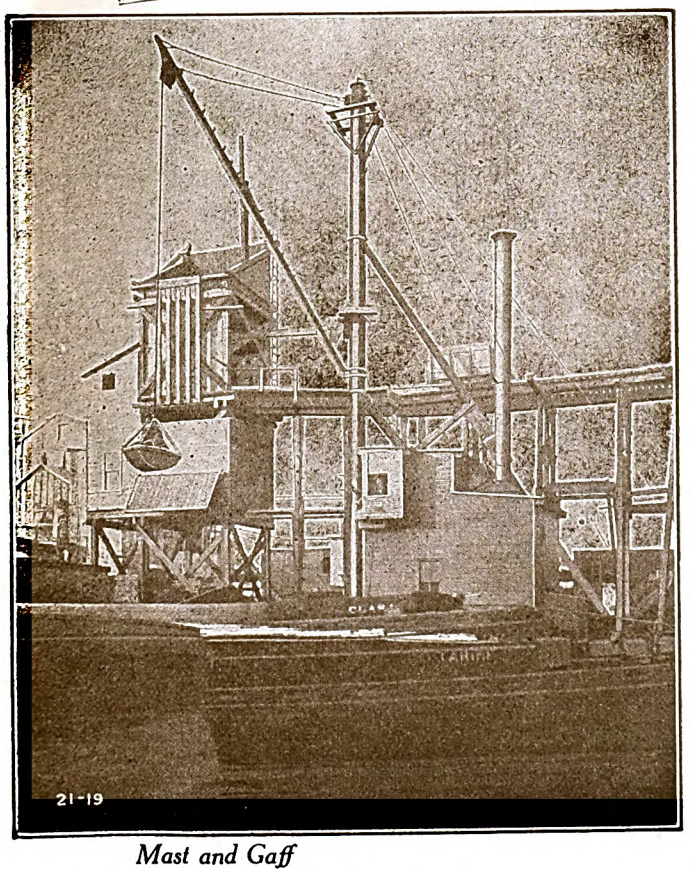
CONVEYING HUNT APPARATUS



Cable Railway



Skip Hoist



Mast and Gaff

Five Distinct Types for Cutting Handling Costs

THE diversified equipment shown on this page is saving in the cost and aiding in the speeding up of production in the various plants where they are installed.

By moving bulk materials without loss of time, at least expenditure for labor, maintenance and operation, they reduce to the minimum, wastage in the three essentials to profitable output—time, labor and money.

Built rugged, to withstand hard usage, they are nevertheless made with infinite care to insure proper functioning of every part to give the longest and most dependable service. This attention to the smallest details has been the Hunt policy for over half a century.

HUNT CABLE RAILWAY

For handling coal and heavy material from point to point. Used extensively in conveying coal from barge to storage bins. Standard gauge 21½ inches; curve radius 12 feet.

HUNT SKIP HOIST

Applicable to many material-handling problems. The automatic operation is controlled by the pressing of a button which sets in motion the elevating machinery drawing the bucket to the top of the tower, where the load is automatically dumped and the bucket descends. The picture shows two skips handling coal and ashes.

HUNT MAST AND GAFF

The simplest and most economical method of handling bulk material from barges. Easy to install; low in first cost; maintenance and operating costs at a minimum. Electrically or steam operated.

HUNT ELECTRIC MOTOR CARS

Rapid, rugged, reliable vehicles for transporting bulk, bagged and cased material. Single and double truck drives; built to operate on third rail and single and double overhead trolley systems. Operate on 12' 0" radius curves.

HUNT WEIGH LARRIES

Built to meet existing conditions with one way bifurcated chutes, to serve a single or double line of stoker hoppers. Accurate records of coal consumption registered on cards. Manually or electrically operated, either from boiler room, floor or cab.

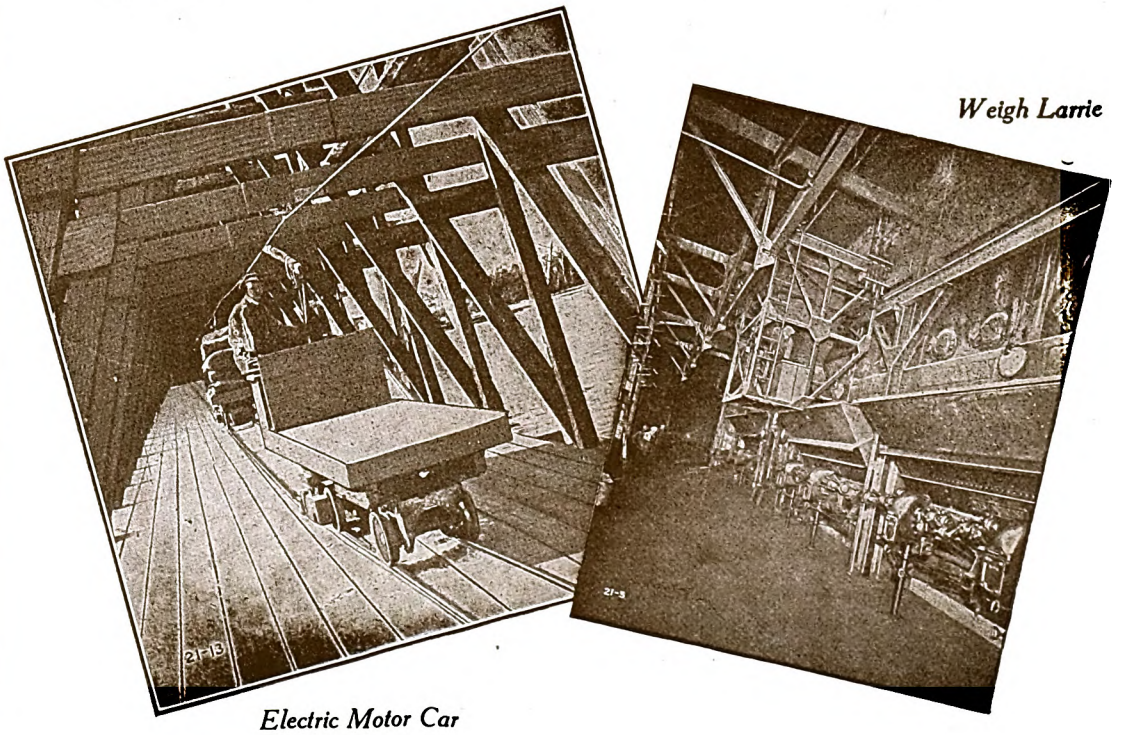
Let our engineers study your conditions and submit recommendations that will help put your plant on a profit producing basis—no obligations to you.

C. W. HUNT COMPANY, INC.

WEST NEW BRIGHTON, NEW YORK

Ernest F. Learned
141 Milk St., Boston 9, Mass.

Philips, Long & Co., Inc.
538 So. Dearborn St., Chicago, Ill.



Weigh Larrie

Electric Motor Car

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Lay in a Good Supply When Coal Can be Had

IT is your insurance against strikes, snow storms, car shortages and high prices next winter.

Learn by your experiences of preceding winters.

By use of the Scoop Conveyor you can make any open space about your factory an ideal site for your coal storage pile.

This machine unloads cars, loads trucks and transfers any kind of coal at the rate of a ton a minute and at a minimum cost per ton.

Design and construction based on that genuine practical experience gained through years of manufacture, installation and maintenance of thousands of portable belt conveyors, guarantees dependable economical, long time service.

Write for Catalog No. 158

Portable Machinery Co.
PASSAIC. N. J.

ask any user

THE SCOOP CONVEYOR

(*Continued from page 52*)

and defeat him, does not seem to arouse contempt in the workman for his superior in the plant.

No definite appropriation for athletics is made, such expenses as arise being cared for by individual allowances. Uniforms and other equipment are furnished such teams as use them, cups and other prizes are offered from time to time, and items such as transportation for the teams when they go out of the city are to be cared for. When these expenses are to be met, the recreational director submits a request to Mr. Slack for the amount needed and he puts the request through the proper channels.

In addition to their contests among themselves, Studebaker teams and individuals are leaders in all the phases of the work of the Detroit Amateur Athletic Association and in several Industrial Leagues.

A "New" Science, More Than Five Generations Old

(*Continued from page 17*)

of equipment is saving millions of dollars per year and is handling everything from grain to ashes. In some of the largest chemical plants throughout the country there are miles of conveyors and dozens of elevators. To enumerate the various material handled in this manner would require considerable space.

The equipment shown on pages 15 and 16 performs jobs and operations that, under present labor conditions, it is next to impossible to get men to perform. And why? Because the average laboring man does not care to do such heavy lifting and hauling, and the old days of "bull strength and a loud voice" are past. This matter of materials handling is just being given its proper place and we will find, as we investigate what has been done and what can be done, that a knowledge of the subject is worth money in more ways than one.

Take any picture in this group and see if you could perform the operation any cheaper through the use of manpower. How many men would it require, to move such loads by hand or by hand-truck? How many times would each piece have to be handled, due to the loading and unloading of these hand trucks? What would the cost be? These are all pertinent questions, but they are questions that each plant executive should ask himself regarding the methods of handling materials *in his own plant.* It does not matter whether you are using mechanical equipment or not; it is highly probable that by reviewing your handling problem you will find a number of places where improvements can be made, with the resultant savings in money.

The photograph on page 16, which shows a monorail handling tomb-stones, recalls to the writer an instance where a piece of materials handling equipment (a portable elevator or tiering machine) was used in a mausoleum to elevate the caskets when placing them in crypts. It is the only instance, to my knowledge, where this type of equipment is used as a passenger elevator.

Accepting the writer's suggested definition of materials handling as "the Science and Art of conveying, elevating, hauling, transporting or handling of materials from one location to another," it will readily be seen that the subject is very broad; and the very broadness of the subject is the reason why the average person has overlooked it.

Within the last few years, the American Society of Mechanical Engineers have segregated the subject, as a thing separate and apart from ordinary mechanical engineering. They even went so far as to form a Materials Handling Section of the Society in order to aid the advancement and discussion of this subject. A number of colleges are now planning a section of the me-

(*Continued on page 56*)

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THE COAL CRISIS IS OVER

but Vigilant Feed Water Regulators are being installed in larger numbers and that's another good thing.

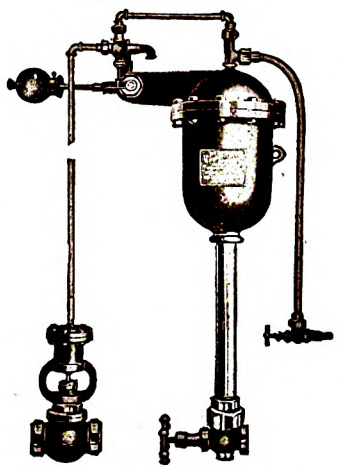
That's one good thing.

The need for saving coal is greater than ever for two reasons—coal has been higher in price than usual, and the quality has been lower, thus requiring the use of more coal.

Many companies are finding out that by installing Vigilant Feed Water Regulators they can keep the water level constantly within one-quarter inch of center gauge regardless of load or method of firing, and be assured that coal is not being wasted unnecessarily.

For the highest overall operating economies—you need a steady water level at all loads—for a steady water level at all loads; you need a Vigilant Feed Water Regulator. The first step is to find out, without obligation on your part, what the Vigilant will do for you. The second step is to write for catalog today.

VIGILANT Feed Water Regulator



Write for the catalog today

The Chaplin Fulton Mfg. Co.

28-36 Penn Avenue
Pittsburgh Penna.

Photographic Record Paper

For COPYING MACHINES

Back to Pre-war Prices

THE RECTIGRAPH COMPANY manufactures its own photographic copying machines and coats its own photographic paper, the entire plant being devoted exclusively to this line. Due to a lowering of the prices of some materials and economies effected in our new plant, we are enabled to announce a reduction of 20% from the prices prevailing on photo-copying paper for some time past.

Revised Prices on Rectigraph Paper

ROLLS 350-FT. LENGTH

8½-inch width	$10.68
9½ " "	11.93
11½ " "	14.00
12¼ " "	15.45
13 " "	16.00
14 " "	17.59
15 " "	18.84
18 " "	22.00
18¼ " "	22.90
24¼ " "	30.45

F. O. B. ROCHESTER, N. Y.

Rectigraph emulsions are coated upon a high grade 100% rag stock, producing excellent results with a durable base. Rectigraph paper is a contrasty bromide paper with excellent orthocromatic qualities, and will reproduce colors perfectly. All the speed consistent with good quality.

The RECTIGRAPH COMPANY has always regarded acceptance of an order as a pledge that it would be filled at the earliest possible date. The output of our plant belongs to our customers with orders on our books. This policy compelled us, during the past few years, to decline much desirable business which would have been highly appreciated, but this could not be considered without prejudice to previous connections. Improved facilities in our new plant enable us to increase production and quality and to decrease manufacturing costs. ***Our Customers will benefit.***

It may be to your interest to become acquainted with Rectigraph paper. We would be glad to receive your order for a sample roll, spooled to fit your photographic apparatus. You can then judge of its merits.

Rectigraph Company

(*An Independent Corporation*)

ROCHESTER, N. Y.



It Pays— In increased Production

A cooling drink and back to work—with EBCO Bubblers close at hand, the minimum time has been spent in going for a drink.

Modern production requirements necessitate the elimination of useless steps to distant hydrant or water pail with their dangers to the health of the workers.

EBCO Bubblers are built solid, substantial and sanitary—they are economical because of their rugged construction. No frills or unnecessary parts—EBCO Bubblers are all service.

Start now for maximum production during the hot sultry summer days by investigating the advantages of EBCO Bubblers.

Write for illustrated catalog and prices.

The D. A. Ebinger Sanitary Mfg. Co.

W. Town St. & H. V. R. R.
Columbus Ohio

Minneapolis, Minn.
Hampshire Arms

New York City
101 Park Ave.

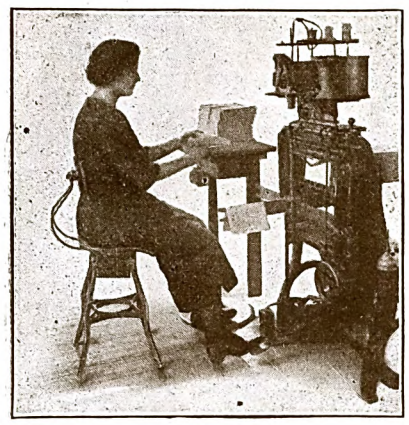
Detroit, Mich.
3942 Commonwealth Ave.

Charleston, S. C.
258 Congress St.

EBCO BUBBLERS

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UHL STEEL PosturChairs



The illustration shows seat tilted forward which brings the back with it. Note the straight line spine and the properly located back support.

This bindery operator is scientifically seated upon a Uhl Steel PosturChair, which increases her production, furnishes comfort during the entire day. And, her body is in the position health demands it should be.



The Uhl Steel PosturChair fits the body. The seated skeleton shows correct support. Note how the pelvic bones are relieved by the seat shape.

Fatigue is the thief of production. Incorrect support of the body breeds poor health. No employer would knowingly sanction impairment of health resulting from wrong chairs. And, increased production is being sought by every means. The Uhl Steel PosturChair is the answer.

PosturChairs have been designed in conjunction with, and are approved by the American Posture League of New York. Each chair bears label of approvel.

SPECIAL FEATURES: Made of cold rolled steel except seat and back which are wood. 10 heights each with 3" height adjustment. Seat tilts forward or backward. Swivel seats when wanted. Durably built, neatly finished.



This is the No. 8150-V-WB, 28" high adjustable to 31". Nine other sizes. Note shape of seat. Sit in it and be convinced.

TRY ONE AT OUR RISK

If you are seeking more production and greater health protection for your workers, write us for a sample to try under your own conditions. It's free for two weeks use. Mention height needed. Descriptive pamphlets available.

THE TOLEDO METAL FURNITURE CO.
1606 Hastings St., Toledo, O.
Manufacturers of steel equipment for factories, stores, offices and schools.

(*Continued from page 54*)

chanical engineering course, too, so that definite attention can be paid to materials handling and the design of materials handling equipment. Others are planning special courses on the subject.

Such action on the part of Colleges and the Engineering Society indicates that the next ten years will bring forth many new developments and improvements. The past is rich with experience, but because of lack of foresight on the part of the equipment manufacturers very little definite operating data is available. The present problem, when investigating this subject, is to obtain this data in written form. Many private engineers and some industrial plant executives have this information, but it needs wider circulation. Let us trust that more of this personal knowledge will find its way to the pages of the technical publications, so that all may benefit by the experience of others.

The Deserted Power House

(*Continued from page 26*)

ban (an automatic one, of course) will start up at the approach of a single car, and when the car has passed its radius will shut down again. No one is required to operate the station.

Of course an overload will cause damage, as, to melt the transformers and converters by overheating. The stations must be protected. When there is a blockade on the street car company's tracks the station automatically throws the excess load to adjoining stations, and reduces the load by means of reducing the voltage, which make the cars run slower.

It is said by authorities that the automatic station is more reliable than the regular operated houses with the human heads and hands in charge.

In case of trouble a light notifies the passing motorman that the station is out of service, and he telephones the office immediately.

The automatic station will carry an overload of 50 per cent. for two hours. These stations have solved a difficult problem in splendid fashion.

Figure the Cost Yourself



Anderson adjustable lighting fixture over sewing machine installation in C. G. Gunther's Son's, Furries, N. Y.

The actual cost is several hundred per cent. less than nothing. Users claim increased efficiency from 5 to 25%. Take a minimum of 5% on $5 a day operator using artificial light with arm two hours a day and the least possible saving amounts to $18.75 a year. Add an average saving of $6.60 per operator on electric light bills, less first and replacement cost of the smaller lamps used, less breakage and elimination of fuse blow-outs and you readily see that.

Anderson Self-Adjusting Arms

will pay for themselves over and over again each year at the minimum of saving.

Increased efficiency is an important matter to consider. In plants where the Anderson Localized Lighting System have been installed the workers have always shown marked appreciation—it enables them to handle their tasks with less strain in shorter periods.

Do away with the antiquated method of "lighting the whole factory to thread a needle."

A demonstration by our lighting engineer entails no obligation. Send for a list of plants that we have already equipped.

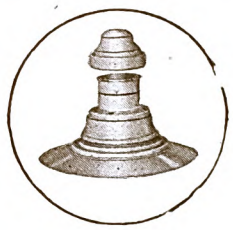
Localized Lighting Corporation

of American Electric Equipment Co., Inc.

1478 Broadway New York

G.P.&F. Service
Knowing How Since 81

STAMPINGS—Pressed Metal Parts



Always Lighter—
Universally Stronger—
Generally Cheaper.

Many of the STAMPINGS and SHEET METAL PARTS that we make for the hundreds of manufacturers were formerly castings, forgings or wooden parts. To these manufacturers we have already proved the advantages of G. P. & F. Service.

But if you are already a user of pressed metal or make stampings in your own plant it will pay you to get our estimates on the work.



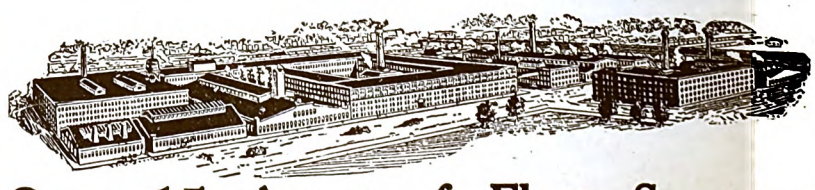
This 15 acre plant which every day turns out 100,000 parts of every description, in steel, brass, aluminum, copper, monel and zinc is devoted exclusively to the manufacture of stampings and pressed metal.

Our facilities and efficient production methods enables us to deliver pressed metal parts to your plant cheaper than you can make them in your own plant.

Prove it? Certainly. Send blue-prints or samples for estimates and compare.

GEUDER PAESCHKE & FREY CO.

1457-1750 CANAL ST., MILWAUKEE, WIS.
CHICAGO: 352-358 WEST OHIO STREET

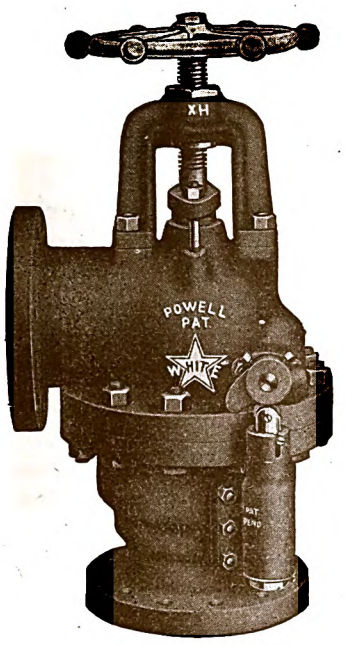


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Safety Insurance for Your Plant



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Powell Triple Acting Valves automatically close when a tube bursts —isolating the boiler.

POWELL WHITE STAR VALVES

guarantee the user unfailing dependability because they combine the most practical and serviceable mechanical factors.

Two reasons for their long life are their regrindable, renewable discs, both cast of Non-Corrosive Powellium Nickel.

Medium and Extra Heavy for steam working pressure up to 200 and 300 pounds.

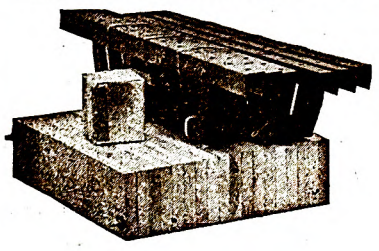
Write for our latest booklet.

The Wm. Powell Co.

2525 SPRING GROVE AVENUE CINCINNATI, OHIO



At Right:—3 Enterprise Platforms assembled.
Below: — 3 Enterprise Platforms ready for shipment, showing why they take a class three freight rating.





Shipped Anywhere at Low Cost

Last Indefinitely

The combination wood and steel construction of Enterprise Platforms makes them so strong and durable they last indefinitely. They won't break down under heavy loads like the all-wood platforms you make —and practically eliminate the expense of costly repairs or replacements. In final cost the cheapest platforms you can buy or make.

Made in all Sizes

If you will give us the following information we will quote you promptly on a platform to meet your requirements:

Measurements Desired

Length of top over all.....
Width of top over all.....
Clearance between runners.....
Style elevating truck used.....
Height of truck base when lowered.

ENTERPRISE PLATFORMS for elevating trucks are shipped *anywhere* at an *exceptionally low cost.* They come to you knocked down— take a class three freight rating— which means a substantial saving on the shipping cost.

Everything is complete, ready to assemble, with necessary bolts, nuts and lock washers. Top boards are finished on four sides, cut to length, bored and countersunk for bolts. Easily assembled in a few minutes.

Enterprise Platforms cost *so little,* and are built *so strong,* you can't buy or make platforms of equal strength for less money.

Send measurements and get descriptive literature and prices.

ENTERPRISE IRON WORKS
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ENTERPRISE PLATFORMS

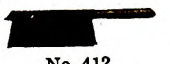
For Elevating Trucks —Hand or Electric

Standard for Forty Years

ECONOMY



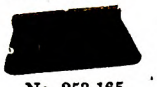
No. 256-144
Steel wire
Push Broom



No. 412
Bench Brush



No. 28-H
Bassine Whisk



No. 253-165
Bass Push Broom



No. 3-W
Steel wire
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Brooms that have won the specifications and re-orders of 40% of the railroads, 40% of the steel industries and over 4,000 leading industrial plants, large and small,— with a record going back 46 years—

HAVE EARNED A RIGHT TO SWEEP FOR *YOU*

Lay Metal Case Brooms wear about twice as long as ordinary brooms; they hold their shape. They hold their customers.

SEND FOR LATEST PRICES NOW

For every type of floor and for every material that can be handled with a broom there is a Lay Broom proven in long service. Lay Brooms *must make good* or *we will.* Check and sign the coupon. Mail it to us. Let us show you genuine broom economy.

THE JOSEPH LAY COMPANY

120 College Street

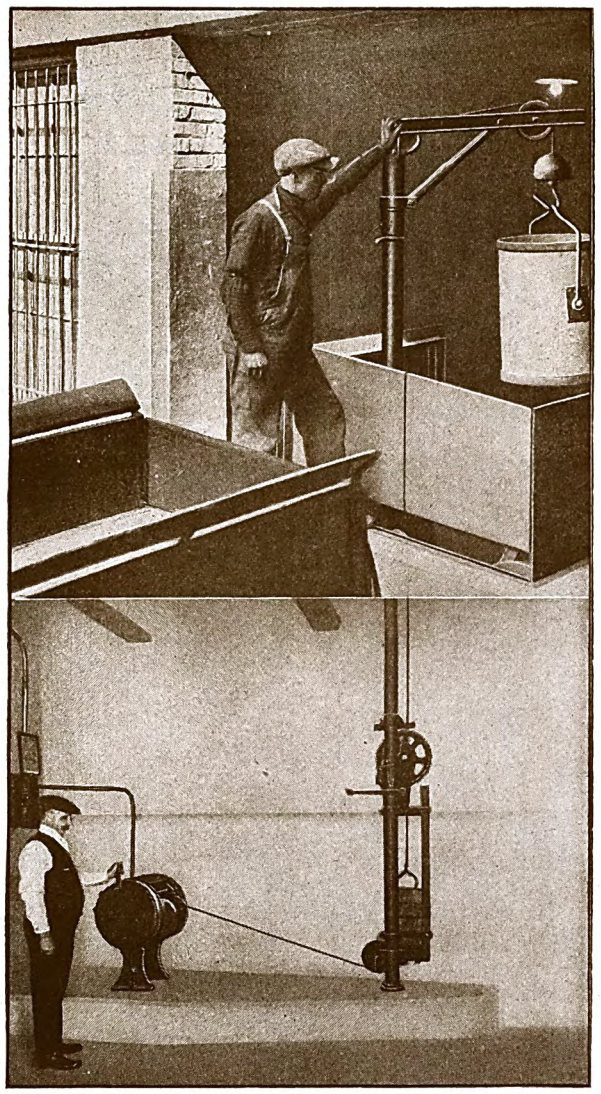
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Originators of the Metal Case Broom

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The Joseph Lay Co.
Ridgeville, Indiana
Please send us your latest prices and recommendations
Floors are (material).....; dry, damp, wet. Brooms must handle dust, heavy dirt, sawdust, filings.
Special uses.....
Firm Name.....
Location.....
Inquiry by.....

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Railroads believe in safety. Note use of G&G sidewalk doors with spring guard gate to protect sidewalk opening

Railroads too, find this Hoist desirable for ash removal

THE Illinois Central R. R. has used a G&G Telescopic Hoist (Model C) since November, 1919, in its 53rd Street freight station in Chicago. This model is operated electrically at very small cost for current. (A recent test of an electrically operated G&G Hoist indicated that ashes were raised at the rate of 15½ tons in one kilowatt hour.)

The Pennsylvania R. R., the New York Central Lines, the Baltimore & Ohio, the Southern Railway and the Canadian Pacific are a few of the other railroads using G&G Hoists for ash removal. Hundreds of factories, institutions and garages are also removing their ashes the G&G way.

Write for booklet "Industrial Plants Need This Hoist."

GILLIS & GEOGHEGAN

556 West Broadway New York City

The G&G ELECTRIC REG. U.S. PAT. OFF. Telescopic Hoist

The Pot of Gold Under Our Hats

A Workable Recipe for Business Success

By Frederick H. McDonald

HOW atrociously poor so many of us are. And what a fine piece of drollery that so few of us want to be poor!

How often the slogans catch and hold our eyes—"More money for you!" Unerringly they prescribe that which is beyond most of us—the investment of actual money. So we pass them up, a nod of recognition tempering our regretful good bye. They are fine enough for the other fellow but downright awkward for us.

Yet, there ought to be some way out of it all. Not that we give a continental, of course—it's the principle of the thing! Those of use who have cut our eye teeth have long ago discarded the notion that the world owes us a living. We have regretfully vetoed the fallacy fathered by our constitution that all men are created equal, and have come to recognize that in our democratic country it is to equal opportunity and not equality of station that we are born.

The great question with us all is how to realize this opportunity. Not how can we spend more. How, with what we are already endowed, can we make more?

Have you ever seen that picture of a sad looking old Bossie stretching her neck over a rail fence, trying to curl her hungry tongue around a neighbor's lean corn blades—and herself up to her knees in rich green clover? Well, aren't a lot of us like that? Always looking somewhere else, or to somebody else, for our big chance, when as a matter of plain fact we already have within us the power to start our own selves chugging up the grade to a piping measure of success.

How often have we looked back over our work or a portion of our lives, and figured on how much work we could have accomplished if we had really exerted ourselves—had really pulled out of ourselves the qualities we always felt were there. How often are we surprised when we see a man thrown up against a situation for which he has seemed to have had no adequate preparation or experience, to find that he measures up well to the responsibility, or the opportunity—how great a number of apparently mediocre people are getting away successfully with jobs that we would readily enough have conceded to have been beyond their powers.

The stuff is there—if we would only use it!

Not only in ourselves is it there, but in an even larger accumulative degree is it in those who work with us and for us. So many of us are dependent in getting results upon the coöperation and efforts of others, that it is quite as vital and vastly more profitable to insure a development of their latent capacity as well as our own.

Just as we can cure none of our economic ills by itself, we can get no lasting results in a permanent general advancement by picking on just a few individuals. It is the general level of the whole business structure that must be raised. And it is to the existing structure—our stores, offices or factories—that we can look to find out what conditions are, and just what the possible developments can be. It is towards these that we must direct our efforts if we would create an effective realization of the existence of a great field of possible resource that is now largely overlooked—the clover that is tickling our very shin bones. We can at least try to give some of them a whiff of it.

Now there is a lot of argu-

(Continued on page 60)

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THE SEAT OF
Production



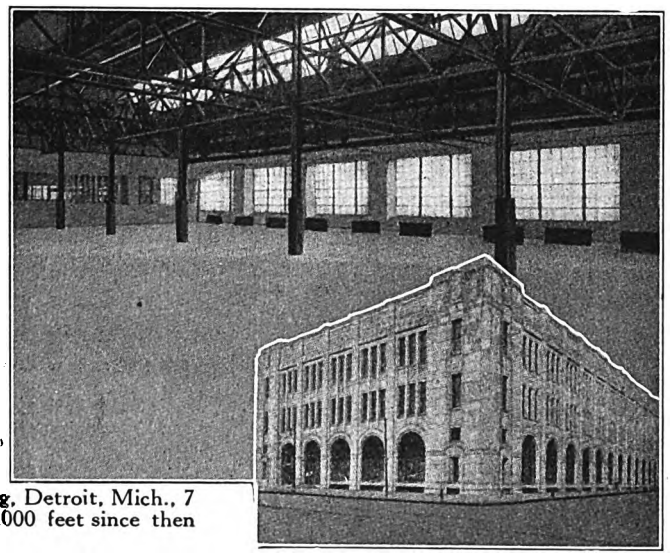
No. FS-22, Patented.
Adjustable Legs and
Back-Rest

The instrinsic value of Factory Chairs and Stools is not in their purchase price, but what they do to increase the efficiency of the worker.

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PRODUCTS
THE CORRECT INDUSTRIAL SEATING

Fireproof
Non-Abrasive
Resilient
Warm
Permanent
Sanitary
No Upkeep
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30,000 feet of Marbleloid installed in the Evening News Building, Detroit, Mich., 7 years ago. 20,000 feet since then on re-order.

Use the coupon below to bring you information about this flooring for Offices, Hospitals, Cafeterias, Welfare Rooms, Laboratories, Libraries, Display Rooms, Workrooms, Power Plants and other rooms in industrial plants.

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The material is manufactured and the floor is laid in seamless plastic form by our organization. The responsibility is not divided, therefore we guarantee the floor in every way.

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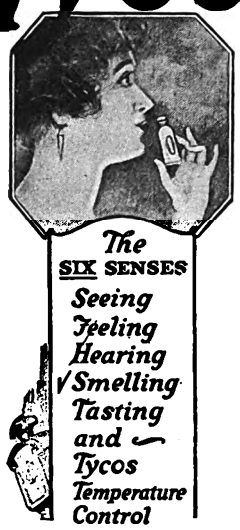
THE MARBLELOID COMPANY, New York City: Without obligating myself in any way, please submit tentative estimates on the cost of your product installed complete for our building.....
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Floor.....Sq. Ft. Sanitary Base:.....Lineal Ft.
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Our floors are
☐ New Concrete ☐ Cement Finish ☐ Wood
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THE SIXTH SENSE OF INDUSTRY

Tycos Temperature Control



If odor alone determined the quality of Milady's perfume!

THE poet who sang so sweetly of "the delicate odor of mignonette" as reminding him of his sweetheart never dreamed that, in modern times, most perfumes would be derived, not directly from flowers, but from the chemical treatment and blending of natural or artificial colorous substances. Thus, the scent of lilacs is produced from oil of turpentine; and the preparation of a substance called "ionone" yields the odor of fresh woodland violets! The story of the creation of every scented article—from toilet soaps and powders to the delicate suggestion of perfume in feminine notepaper—is a romance of chemistry in which temperature control plays a vital part. One of the most important things that must be determined in regard to the essential oils that are the basis of many perfumes is the boiling point. Also, at each different temperature in their distillation, a different product results from the same process. If sense of smell alone guided the perfumemakers, the result might not please Milady's critical taste when the finished product was reached! But to the senses of sight and smell are added that "sixth sense"—Temperature Control—supplied by the accuracy of *Tycos* Pyrometers and other *Tycos* Indicating, Controlling and Recording Instruments. For the most delicate odors, extracts and essences, the most delicate control in distillation becomes possible—the truest knowledge of the exact state of each ingredient—thanks to the exactitude of the information given by *Tycos* Instruments. It makes no difference what the product treated or the result desired.

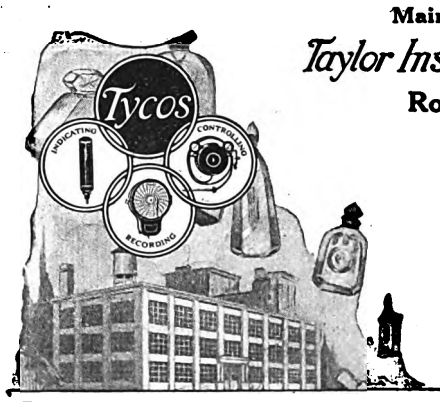
Are your problems chemical? Do they involve the indication and control of heat to the last part of a degree? If so, there is a type and style of Instrument in the *Tycos* Line, embracing as it does over 8,000 varieties.

Write us and literature on any instrument will be sent promptly and our experts will advise you in its application to your processes.

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Tycos Office Thermometers
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Your dealer will show them to you. Ask us on a postal, for booklets on any one of the above.



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Canadian Plant
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There is a *Tycos* or *Taylor* Instrument for every purpose.

Tycos Temperature Instruments
INDICATING · RECORDING · CONTROLLING

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(*Continued from page 58*)

ment going on these days about fundamental propositions that do not seem to have developed as some folks think they ought to have. Our sense of efficiency seems to have led us into a dangerous routine of time and method. We are being warned that our machines are turning us into machines and instead of giving us more freedom of action and thought, are making rutted slaves of us, and killing initiative and effort. We are told that when we determine by time studies that a man can make so many continuous motions per minute without tiring, we fix our standard of performance equally as definitely, set a limit of performance for a given type of work done with given tools by a given type of worker —and that pretty soon we won't be able to increase production to meet new demands. We hear the cry for better types of workers to take over the problems of our big business, smothered by the cry that it is the wastes of our industries that is choking our efforts to get better results.

Always there is some one element that somebody is trying to separate from the whole, to curve off by its lonesome, forgetting, or failing to realize that each is so interwoven with the other that the whole must be ministered to if the parts are to improve.

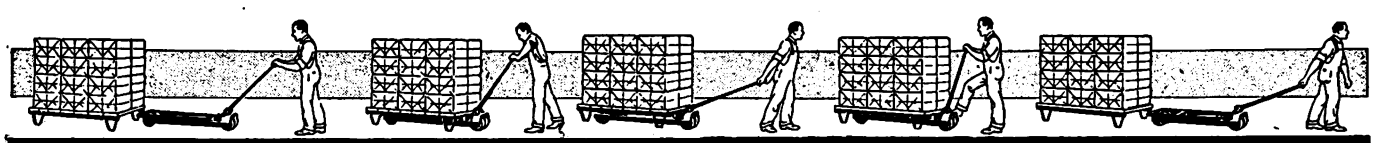
What we want to do is to find some one effort that can be far reaching enough in its effects to help all the parts a little, and thus, by even that little to raise the general level of the whole structure. Something that will clamp down on this thing of turning us into machines—that will cut out some of the wastes in time and energy, and that will enable each of us to better ourselves and our welfare.

We want to overcome to some extent the conditions which make it possible for so much of our lack of success to result more often from our failure to use all of our own potential resources than on the combination of any group of circumstances that might be the apparent cause of failure. We want to find that clover at our feet—and feed on it.

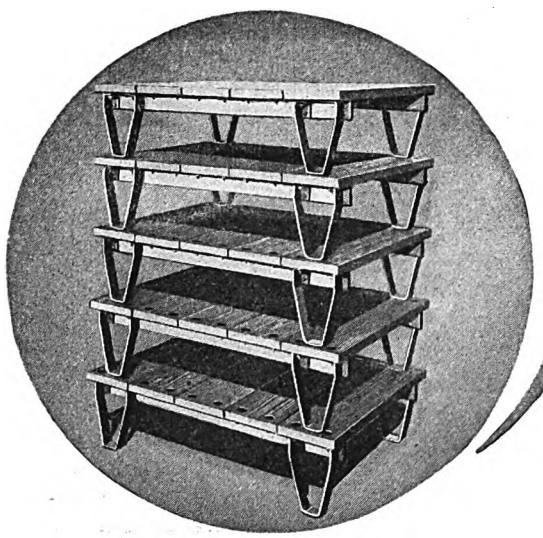
The clover at our feet. Has it ever occurred to you that the real thing exists already—in our heads? Have you ever realized that the greatest dormant force in the world upon which man can draw, or over in any way exercise control, is not the heralded power of the tides, not the vast powers of our unbridled water falls, nor even the unbottled rays of that greatest of visible energizing forces, the sun? That it is the waste power in the undeveloped human mind? Even alone, this is the most effective force in the universe over which we can exercise control —the trained intellect. Just it is the harnesser, the utilizer, and the adapter of all of nature's otherwise unguided powers.

Think of the unnumbered possibilities that even the possessor never realizes exists until favoring chance brings them to light—let us not leave them entirely to chance.

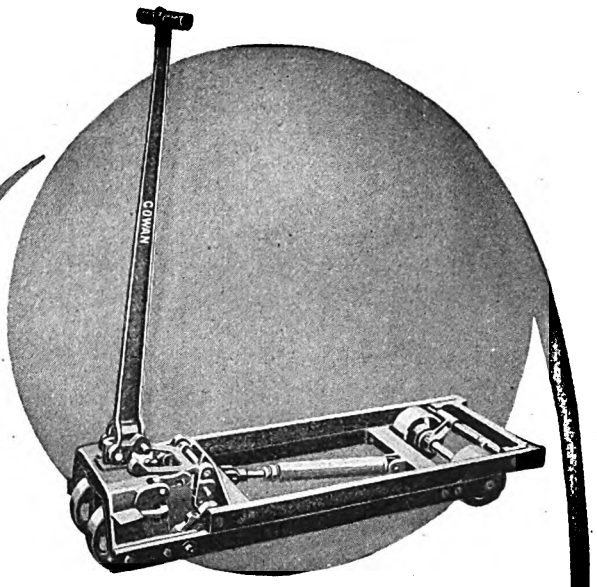
Prior to the war, gauging from the results of time studies and the effects of piece-work and bonus systems, it was reliably estimated that in tasks where he had nothing to gain

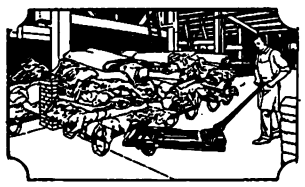


ELIMINATE REHANDLING



Skid Platforms for Your Loads *and* A COWAN Hand Lift Truck





The Cowan System in a tannery. Handling leather



In a lumber mill. Handling door and window frames



In a wholesale grocery. Handling boxed and packaged goods.

HE steps on the foot pedal and with a single downward sweep of the truck handle quickly and easily picks up the skid body with its load.

At destination, he simply steps on the foot pedal—and skid body with its load is quickly and gently lowered to the floor.

His load handling capacity is greatly increased. With one Cowan Hand Lift Truck and its complement of inexpensive Skid Bodies, he duplicates the work of many men and an extensive equipment of ordinary trucks.

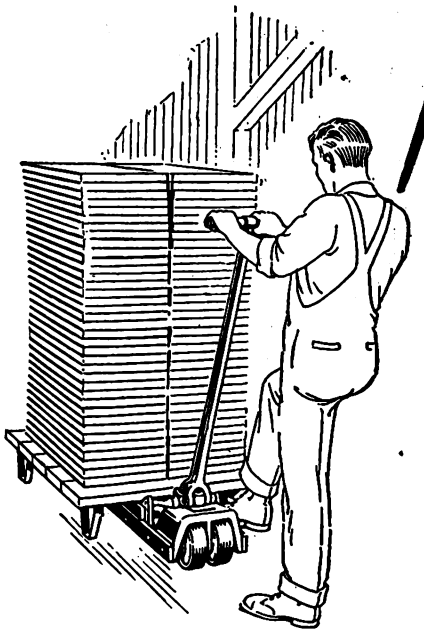
Accomplish more work with fewer men. Reduce your trucking equipment investment. Cut down your truck replacement and maintenance expense.

Cowan Skid Platforms or Bodies are ruggedly constructed but inexpensive. Maintenance practically negligible. A supply adequate to your material handling needs, together with one or several Cowan Hand Lift Trucks, *costs considerably less* than a commensurate equipment of ordinary trucks.

Write for complete information on the application of this Cowan System to your particular load handling requirements.

COWAN TRUCK COMPANY
6 Water Street, Holyoke, Massachusetts
Representatives in New York, Chicago and all other Principal Cities.

Largest Manufacturers of Complete Hand and Electric Industrial Truck Systems.



Under the Skid Up and Away

2067-N

COWAN INDUSTRIAL TRUCKS-TRACTORS



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by extra exertion, the average efficiency of the workman from day to day was not over sixty-five per cent. of what he could accomplish. This average could be, and was raised from ten to twenty-five and thirty points for continued performance by the use of various systems of payment which gave additional reward for additional effort. While these figures were the result of tests made in the shop with shop workers, there is no reason to believe that they will not apply in a general way for even the white-collared contingent, the administrative forces. In fact they ought to hold quite true for all of us, of whatever class, creed, or line of endeavor in our attitude towards our daily work. The dormant extra continuous effort is in us. All we have to do is provide a recognition of it, and an incentive to pull it out.

When, less than a generation ago, those same time studies and bonuses first turned our eyes from the machine as a unit of production to the man behind the machine as the more vital factor, an era was inaugurated that has put production in the field of science, insuring a possible output sufficiently approaching a hundred per cent. to well warrant a query as to what more we may expect.

Yet we hesitate to think that such results represent the limit of possible attainment in any work. It is true that the physical capacity of the man may be approached. It is equally true that the tools or machines may be working up to their limits. But—what about another type of tool, another kind of machine, or even another form of process? In other words, what about the application of a little brain-work? Though our physical capacity can be enlarged under given conditions, there is a limit beyond which even incentive cannot draw us—the limits of our individual mental capacities have never been even approached.

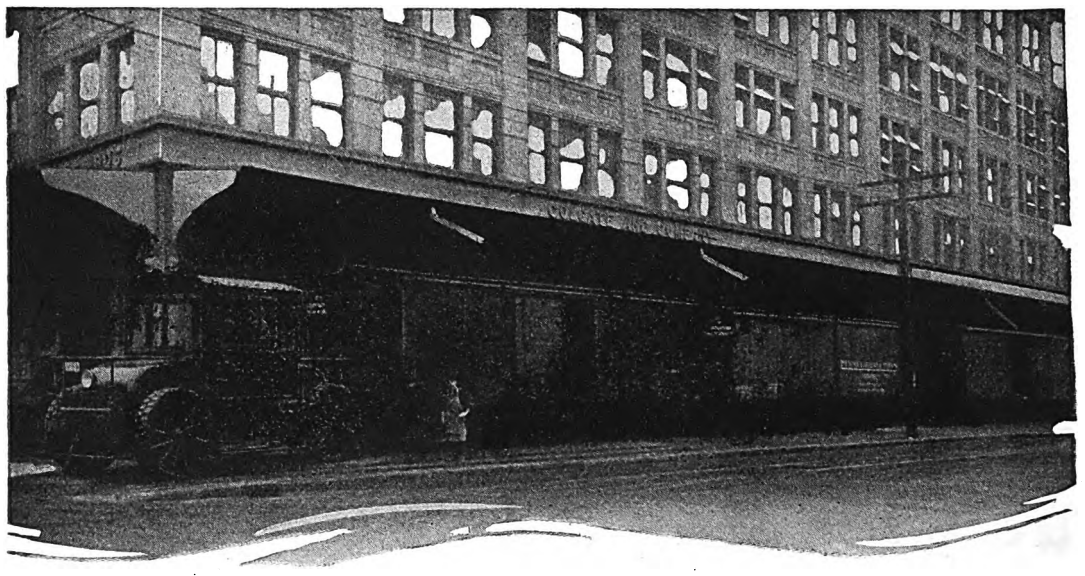
We have now reached the stage in industry and business when we must definitely turn from a study of just the man behind the work, to a further study of the enormous possibilities which lie in developing the brain behind the man!

It is time to weld one more, if not the greatest link as securely in the chain of production as we now have welded together the accepted functions of management, with labor and tools. We must make the widespread acceptance of this term management applicable to the individual worker. In addition to the great factor we now recognize as executive management, we must create a new conception of a personal management of his own job by each individual.

If employers can ever succeed in instilling an appreciation of the work to be accomplished, instead of the machine to be run, the car to be sold, or the books to be kept, in the man who is tackling a definite task, we reach up into the illimitable field of human imagination and ingenuity. Instead of being in danger of reaching the limit of production, we will find that we have so far only tapped the real capacity of our workers, and have put it within the lot of each of them to better himself and his welfare.

The accepted task of the

SKF



Ball Bearing Electric Tractor

Hauls Freight Cars at Cost of $.067 per Car Mile

STORAGE-BATTERY tractors were put in service in 1913 in Jersey City to replace horses for hauling freight cars to the doors of certain industrial plants.

During the first seven months of operation, 4,935 cars were handled at a cost of $4,627.88, or $.067 per car mile, as opposed to $9,179.10 with horse haulage. These tractors weigh 28,850 lbs., are equipped with two 85-volt, 60 ampere, 900 R.P.M. motors and have a draw-bar pull of 8,000 lbs.

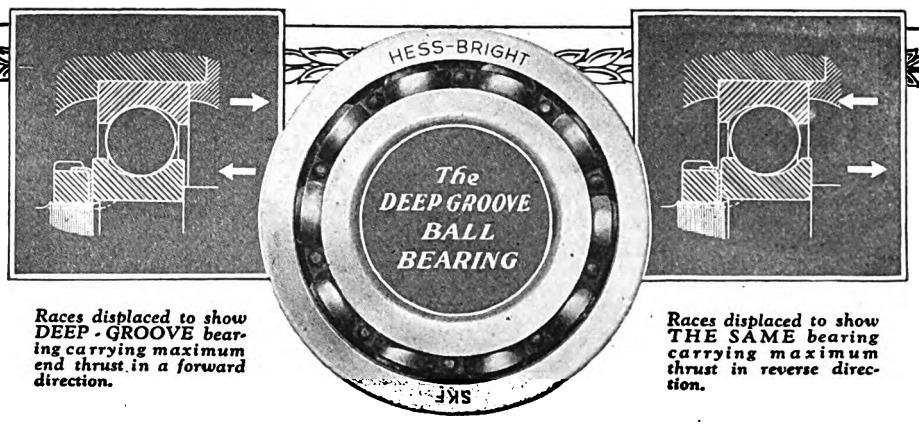
Deep-groove ball bearings made by the Hess-Bright Manufacturing Company are used on the motor shafts, motor pinions, counter shafts, differential gears, driving wheels and steering-gear pinion. In this way the maximum mileage from a battery charge is insured and the rotating parts are protected against displacement, as ball bearings operate practically frictionless and develop no appreciable wear.

Whether your bearing problems deal with railway, automotive, industrial or scientific equipment, the services of our engineering department are at your disposal.

THE HESS-BRIGHT MANUFACTURING COMPANY

Supervised by SKF INDUSTRIES, INC., 165 Broadway, New York City

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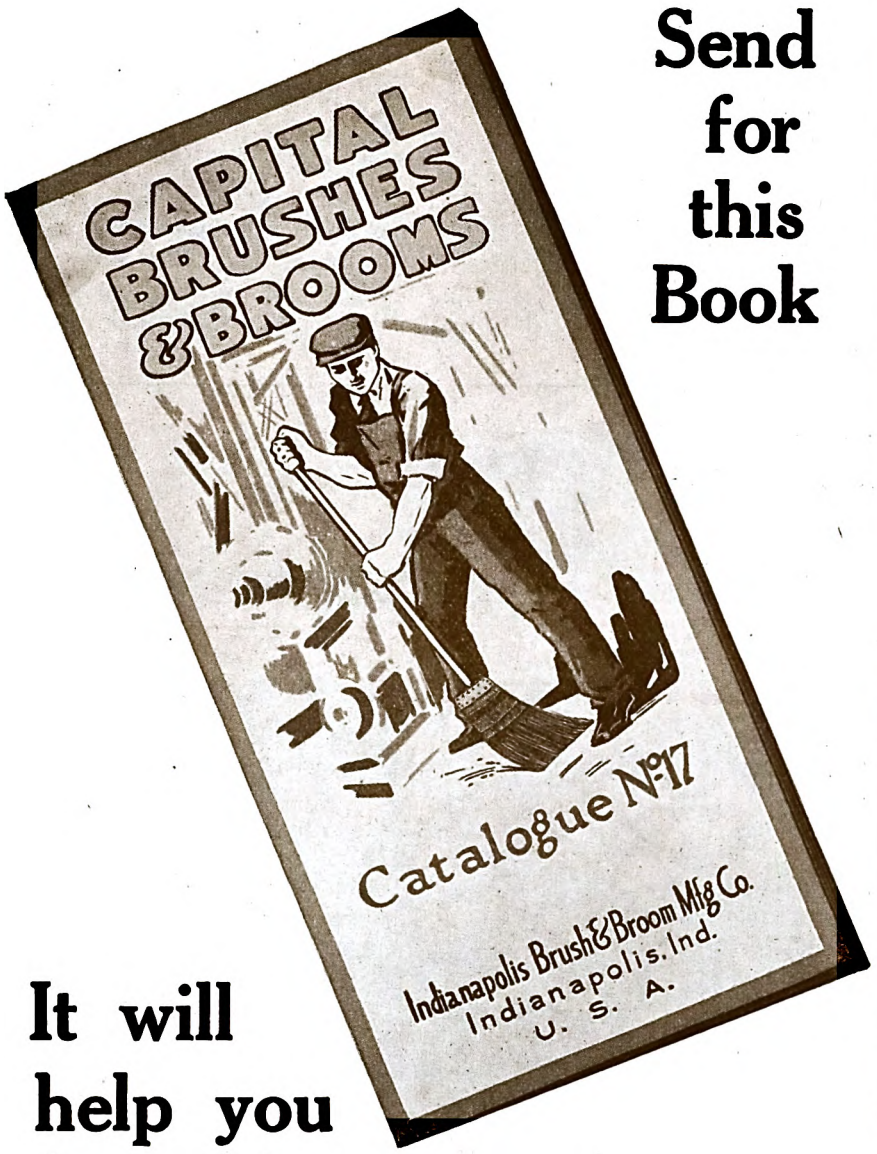
Races displaced to show DEEP-GROOVE bearing carrying maximum end thrust in a forward direction.

Races displaced to show THE SAME bearing carrying maximum thrust in reverse direction.

BALL BEARINGS

The Highest Expression of the Bearing Principle

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This booklet will be very valuable to purchasing agents and other executives who are interested in reducing cleaning costs in their factories. It illustrates and describes CAPITAL Industrial Brooms and Brushes, a line of highly specialized units that meets practically every industrial requirement in cleaning equipment. With this book as a reference, you can select a CAPITAL broom or brush that is built to do just the particular cleaning work that your manufacturing processes make necessary.

CAPITAL
Industrial Brooms and Brushes

Can be used in almost every industry to effect big savings in cleaning costs and to increase the efficiency and speed of cleaning methods.

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Practically every leading mill supply or hardware jobber in this country sells CAPITAL Brooms and Brushes. After you select the equipment that meets your needs, from Catalog 17, you can get prompt delivery from your jobber, who probably also is our local representative. Our jobbers sell to you on our positive guarantee of satisfaction, under which you can return any unsatisfactory goods for full credit, with carrying charges both ways paid by us.

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INDIANAPOLIS BRUSH & BROOM MFG. CO.
I. W. LEMAUX, President
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Name.....

Address.....

now recognized executive is largely the production of ideas and the managing of men in their execution. We are so prone to limit our conception of this function to its recognized channels that it seldom occurs to us that there is as great a field for the creation of ideas by the individual worker. That there is equally as much opportunity for his successful management of himself and the work under him in the part he plays in the great game.

Readily enough we admit that mountains are but the accumulation of minute grains of sand. How have we come to overlook, or at least failed to emphasize the obvious truth that a great job of management can only result from the accumulated successful efforts of an immense number of small managers? The individual in this mountain of accomplishment must contribute at least a fair bit of good management to his own efforts if the aggregate is to even approach soundness or completion.

When we fail to see these things, we are unconsciously furthering a continuance of the great economic disease that is today being made the subject of unlimited study, conference and discussion—the loss of production through waste. With it is a resulting lack of possible success that affects the ultimate income and the welfare of all of us. It causes all of us to be some poorer; a matter of concern for each of us.

Now there are two kinds of waste in industry: attendant, or inevitable waste; and preventable waste. The first comprises mostly physical material, like the chips from a carpenter's tool, or the cuttings from a piece of cloth made into a garment. These are the natural results of adapting new material to a finished product. There is a whole industry of manufacturers who make machines and devise methods for the use of such wastes; whole laboratories whose sole aim is to turn these tailings from the mines of industrial activity into usable by-products.

The waste with which we have to do, and which is our real concern, is largely one of ineffectiveness of endeavor—the material, time and energy lost beyond recovery because of a thousand inperfections in the methods of control and execution of our work. Hence, it is a man-made waste. It is largely a matter of efficiency; of our failure to register our highest possible percentage in all of our endeavors. With the resulting fact, that only through working upon men can any lasting remedy be found.

There is a growing literature upon this waste and the things people do to cause it. Management is charged directly with the responsibility of the greater portion—from fifty to eighty-odd per cent. But seldom a word is written as to why managers mismanage, or what to do with that why.

One of the most exhaustive and complete attempts in these studies is the recently printed report made by a group of the country's foremost engineers, entitled "Waste in Industry." It is such a marvel of thoroness and exactness as will insure its use for some time to come as a standard of reference. There is an amazing list of holes in the walls of productive efficiency, nearly all of which are matters of loss of production from faulty management of materials, plant, equipment, and men. Curative remedies in kind are called for through the betterment of each of the avenues of failure—but there is hardly a word of better men. The need of better thinkers is doubtless meant to be implied; for there is plenty about wastes, and plenty about the lack of control which rightly is the immediate cause. But there is no effort to go behind the scenes, and seek for the causes of the cause! The remedies to be applied are well conceived, and would achieve in themselves a world of benefit—as far as they go. The mere application of them could be at best but a palliative.

Suppose we do plug up all the sources of preventable waste—who is going to stay on the job to keep them plugged up? Granting their existence through the lack of proper management, will not the same condition of mental attitude and temperament which now permit their existence, eventually permit the same or equivalent wastes? It is admittedly a question of proper management—but what of the man-

(*Continued on page 64*)

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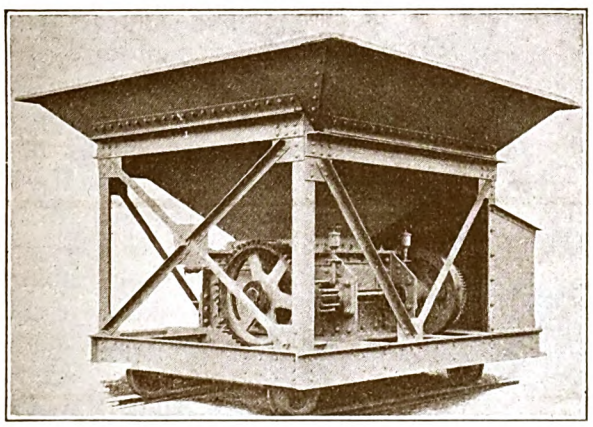
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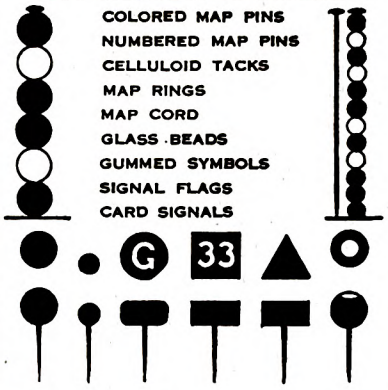
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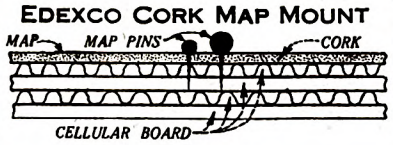
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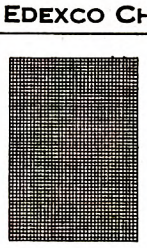
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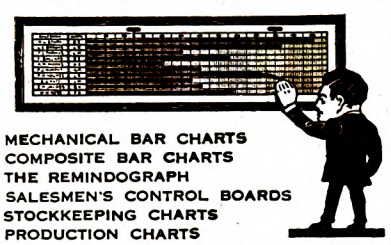
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(*Continued from page 62*)

agers? What is going to make those now responsible for their departments, plants, policies, etc., suddenly become more efficient, more knowing, and more effective? What about the effectiveness of the thousands that carry out the ideas of the executive management, and which in the real analysis are the direct sponsors of these enormous wastes?

The problem for a more generally effective condition in business and industry is the task of getting every executor of work, from officer down to straw-bosses, each to see his task not only just in its relation to himself, but also in relation to his department; to see his department in relation to his organization; and his organization in relation to its industry, and all industry—in such degrees as we can. To get each man's viewpoint and horizon broadened. To get him in the eternal habit of looking for better ways of doing his own and the company's work is the real problem.

Efficiency experts can be employed to the betterment of an entire plant or organization. But even with charted and printed forms, and specified methods of procedure, there will be little continued gain over the first jump in improvement unless the efficiency people be held on the job—which would be prohibitively expensive. We can only evade this necessity of importing better thinkers by teaching the existing force to be its own efficiency guides.

Unfortunately, these things cannot be legislated into our forces any more than morality or economic betterment can be impressed upon a community by the passage of any number of enabling laws. It will do no good for boards of directors or officers to agree that more thinking must be done, better planning and better execution of work, unless they devise some means of making their workman teach themselves to do these things better. The simplest thing in the world—and just about the hardest.

Now our various mental abilities and total capacities for work may be likened in comparison to various sizes of cups, jugs, barrels, and even hogsheads. Some of us when we do our utmost have not accomplished more than a fraction of another's efforts who may be using but a fraction of his ability. It is in the job of increasing both of these things, the capacity for work, and the efficiency of work, that our real task lies. We must make the little cups of ability into bigger cups, little jugs into barrels and small barrels into bigger ones by increasing the horizon, the knowledge, and the judgment of all of our employees. At the same time we must get them into the habit of drawing at all times upon all the knowledge they have. We must increase their effectiveness through increased capacity, and through the use of a full vessel instead of just a portion of their jugs or barrels of ability.

There are already men of ability, naturally, who need no new stimulus to set them to thinking; who already do the historic right thing at the

[(*Continued on page 66*)

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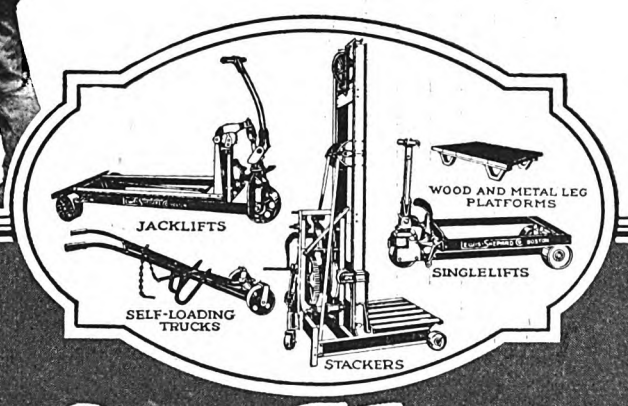
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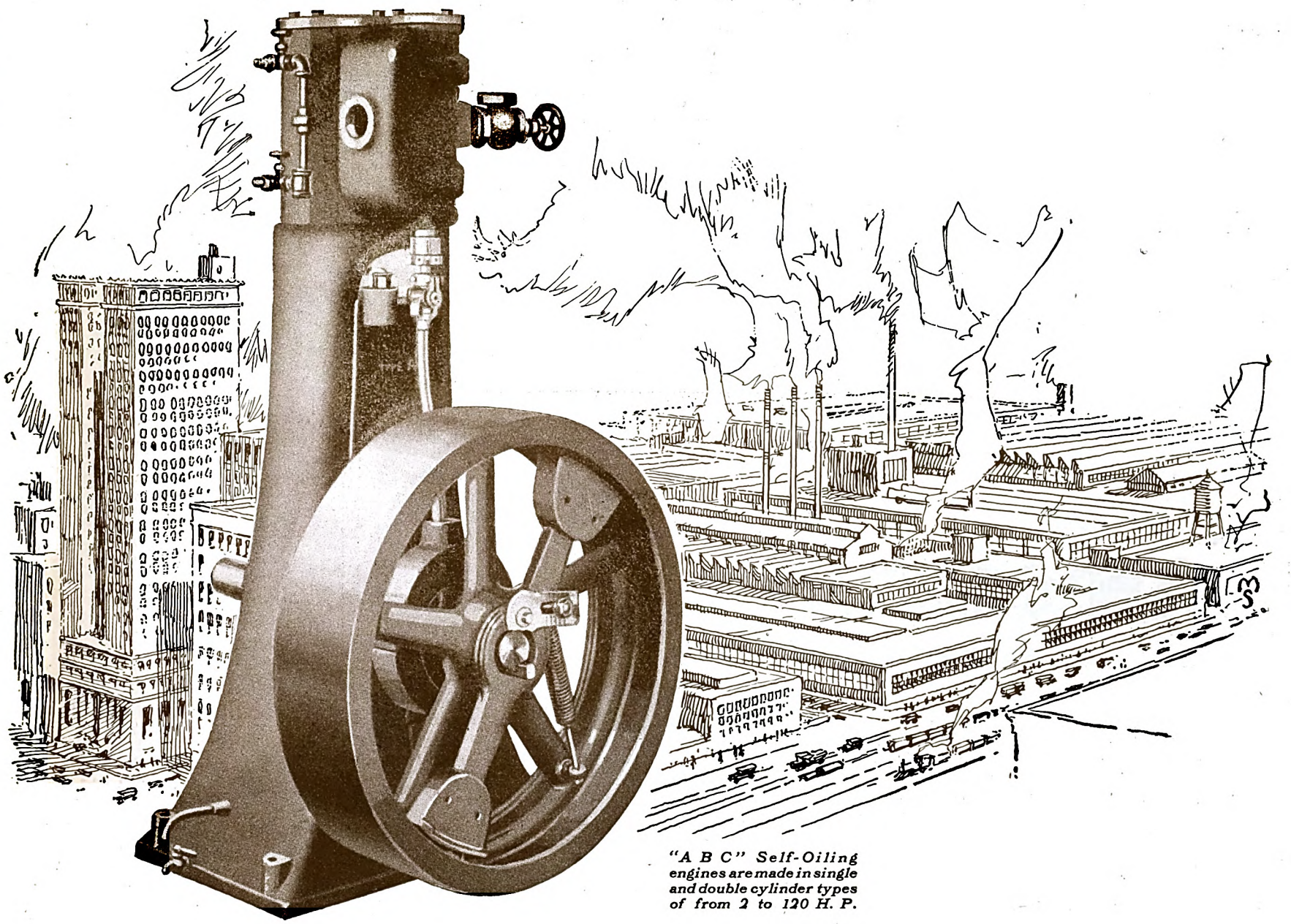




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(*Continued from Page 64*)

right time. Largely, they are men who in addition to the work they are paid to do, put much time and intensive study into after working hours, digging in libraries and in the works of others to find additional light upon the work they have to do tomorrow; for this is the price of success. These are men who may be called self-starters; who do these things of their own accord because they are happier thus, or because they can see no other way of making tomorrow's work better than today's. No way of bringing real thought to the task of today except by illumination from outside of their own work.

There are many of these get-there folk; but there are not nearly enough of them. The great question is how to make more of them.

Leading thinkers, in analyzing influences on human endeavor, are placing less and less emphasis upon heredity, or transmissible traits, and are recognizing that environment is the great factor in determining the characteristics and trends that govern a given person's final aptitudes and ability, and their expression. In other words, even though industry and business cannot get its human material in its infancy, and must of necessity take it long after many of its developing influences have had their first and strongest play, it is still largely raw material. It can actually be molded into desired shapes. Not, of course, indiscriminately. One does not expect lumber to be made into cutting tools, nor cotton fibre into steel cables; but they each have highly special and valuable uses in their own fields. If we recognize that our human material comes to us already classified as certain types of raw material, we can still work each kind into its maximum of utility and performance in the direction for which it is best suited.

There are many, in all organizations, of recognized importance to which these things apply in part. But for each of these there are dozens of relative unimportance except as assistants, detailers, or just plain workers. These form the territory largely regarded as barren of thought, that is to be cultivated—this is the clover that we are trampling underfoot through neglect.

The trend of the day is towards such a degree of specialization in business, that from the petty jobs to the big ones there is almost no such thing as an all-round man. We grow in chosen, perhaps, but well defined channels of work. Once we get launched, we are pretty well shut off from the views and influences of other lines. Yet, in a given business, though there may be a dozen different lines of activities—from buying and manufacturing, to accounting, advertising and selling—they all have a close relation, and are interdependent. They are all about the same thing, and are driving towards the same end. To be really creative in mind, one must know at least a little something of the bearing which many of these varied lines have upon one's own work. We should realize that none of them is enough isolated to permit a knowledge of it alone to be all that is necessary for its

(*Continued on page 68*)

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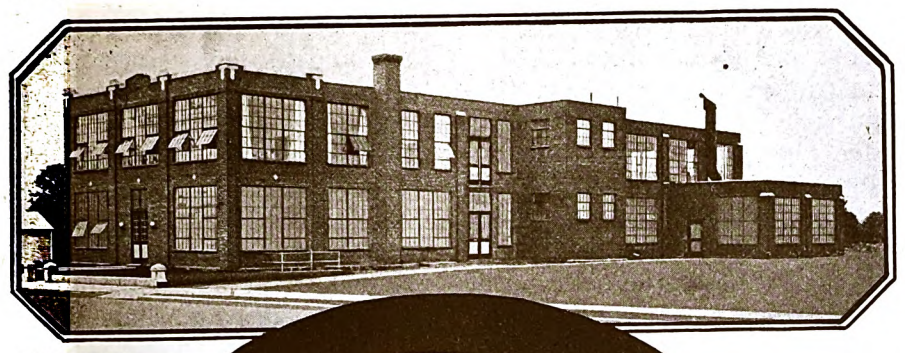
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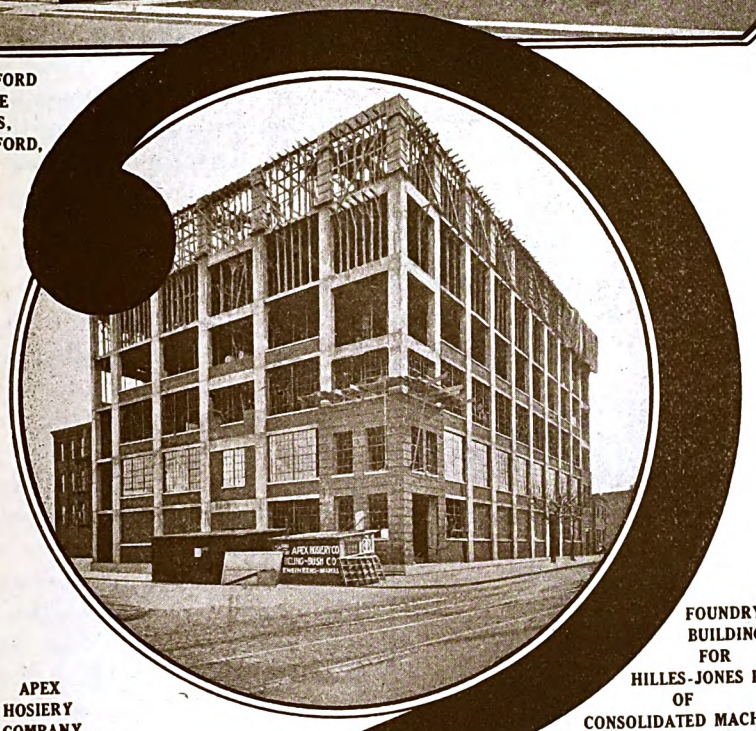
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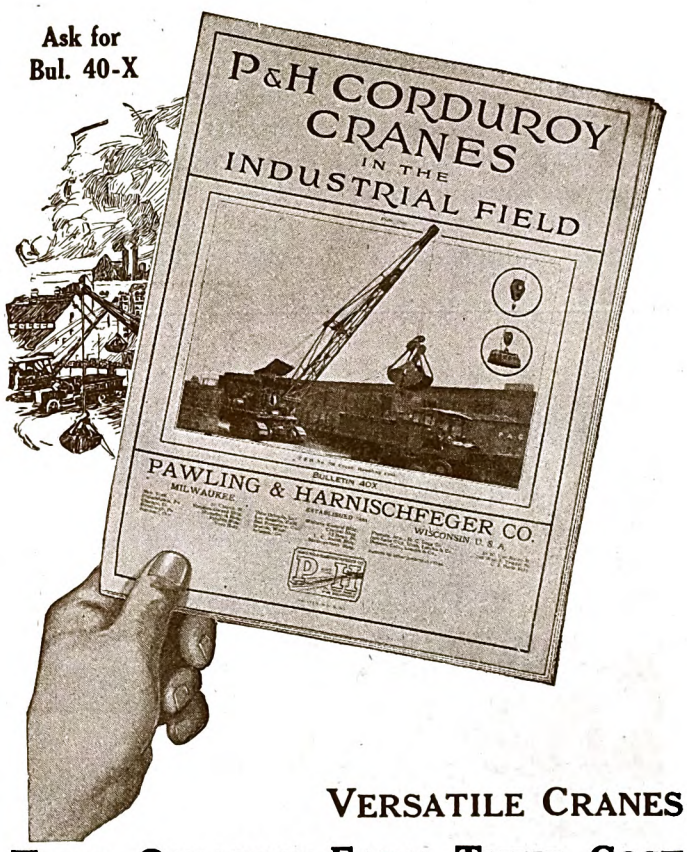
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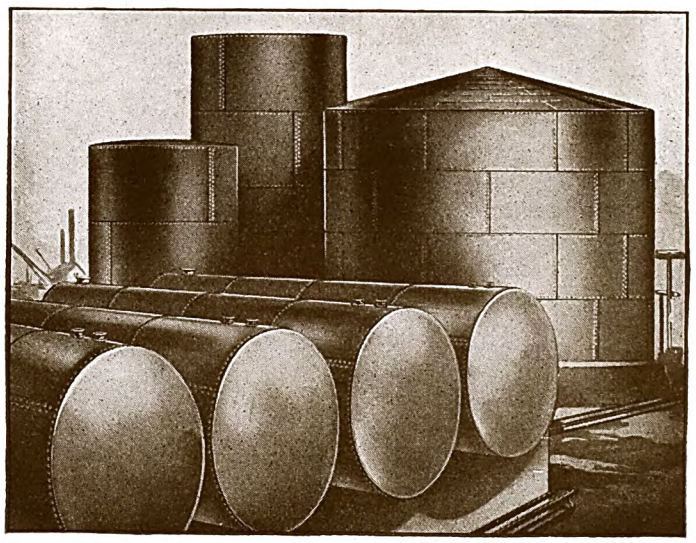
successful operation.

One of the country's greatest personal service organizations, in its last annual conference, actually brought up this phase of the development of constructive imagination, questioning whether in an organization consisting essentially of highly trained experts, sufficient of an all-round viewpoint could be attained to make really constructive thought possible in its highest sense. Whether an over-all viewpoint could be applied to the problem of the client that, in addition to the technical points involved, would take on all the outside factors of production, costs, marketing, etc., that makes many of its problems almost one of economics. As far as can be gathered from the published report of that meeting, everybody admitted the advantage and necessity of such points of view. There was no apparent recognition of the fact that the solution of the problem lay right in the hands of the men at that meeting—for the most part directors, and branch managers of the company. They did not see that if such a thing as an overall constructive viewpoint were to be assured among its personnel, it would have to be developed—and could be developed. But not without the thought, time and energy of those very men. They seemed to overlook the possibility of developing something that was worth inestimably more than a matter of mere academic discussion.

Now it is these very annual conferences, or their equivalents, that at present often are futile in their results, that we can use to help us in the job we are after. There is usually such little effort made to develop the instinct for analysis and mental receptiveness, that it is almost a natural condition to find that conferences good in content pass over the heads of many of these who come as delegates. Too often the delegate is made too much a visitor, and too little a participant—too much a listener, and too little a conferer.

Often the prospect of the annual conference, as the time approaches, is looked upon with varying degrees of apprehension, downright fear, anticipation of a jolly good time, tolerance, and even ridicule. I have seldom seen a man eager to go to one in the confidence of getting his troubles solved, and of coming back primed with regular barehanded information that would give him working ideas and methods and opportunities for realizing his expected expansion in the following year's business. As a rule, the programs of these meetings are so lined up as to make the whole proposition partake of the nature of a social atmosphere. The entertainment of the visitors is looked after as a function of the primest importance. There are usually group meetings of various classes of workers, at which the head of the department or phase of the business generally gives a resumé of what has been done during the preceding year. Frequently he jumps in with a smashing drive of criticism, and then outlines what is hoped to be accomplished during the next year, occasionally with definite plans, but more often with just the expression of a hope and

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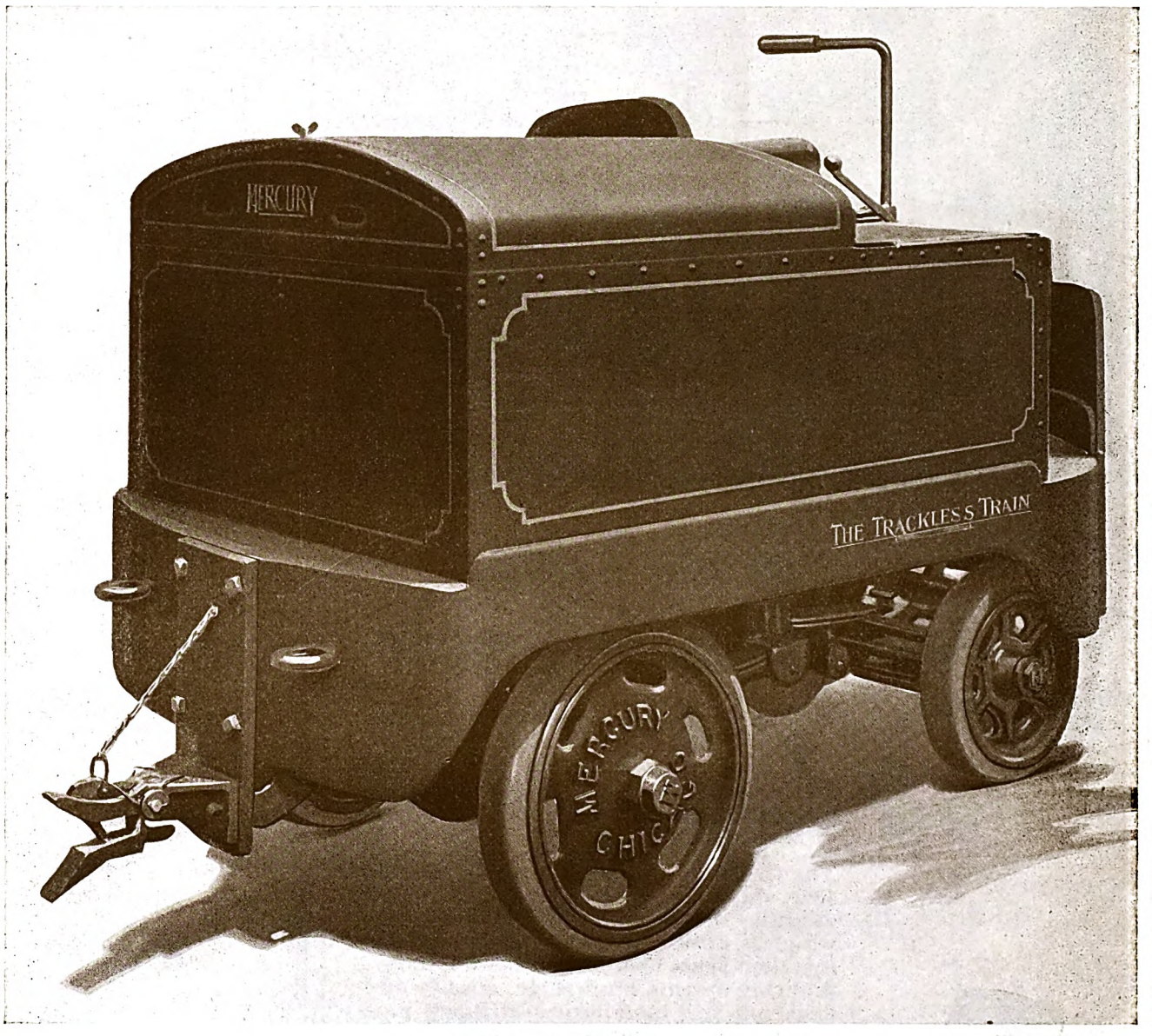
the positive expectation of results. Then toward the end of the whole program, about the third day, there is a large banquet. The inspirational dope is passed out in great gobs for digestion and application—from calls for greater efficiency at less cost, to vivid pictures of possible accomplishment. All of which is supposed to be the momentum necessary to carry the machine through the next year. And the machines *do* go through the next year, a good many times with bigger business and more profit—but get out our indictments of industry again, look at the unplugged holes, and visualize the might-have-been.

I am more and more of the opinion that as now constituted, the great majority of these annual conferences, drawing men from widely scattered territories, at best but take advantage of a small part of their opportunities. That in the main, they represent in themselves a large economic waste both in time and expense. The whole thing is too much a product of the moment when the full year intervening should be used in its preparation. There is too little effort made to develop in the individual the habit of looking today at his work and the work of others and the company's work with next year's conference in mind. With the result that we have not so much conferences, as an occasion for the detailing of the already formulated policies of the directorate—plus the opportunity of pepping-up the executives who are to carry out those policies.

Suppose now that every year, including such of the shop forces as is seen fit, every person in the organization from bottom to top were required to write out as best he could the answers to some such questions as would involve his opinion as to the productivity of his own methods of work, those of his department, or related departments, and of the company as a whole. Opinions both suggestive and critical. Suppose that these opinions were summarized, not picked—for even the apparently inconsequential ones might loom big under discussion— and the grand result of these be made the basis of the annual conference. What do you suppose the result would be? Drivel? Perhaps. But it would not be entirely the fault of the drivelers!

When, as in these times is being quite generally done, the heads of an organization call upon its entire personnel for intensive coöperation,—for the keeping down of expenses, for the turning out of a maximum of work per man, and for a readiness to tackle any kind of job and see it through without additional outside help—they ask for a harder application to work and a steadier grind per man, that the organization as a whole may prosper. But they go on only part of the way in getting that coöperation. They call largely upon the physical side of the individual. They leave unplumbed what might be an immense mental resource in the sum of the ideas of each member of the organization who might express the results of his viewpoint from the outlook and contacts he has, upon the methods that if employed the

(*Continued on page 72*)



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SIMPLICITY—That makes for economy in maintenance and ease of operation.

The M-4 heavy duty tractor is one of the FIVE Mercury types.

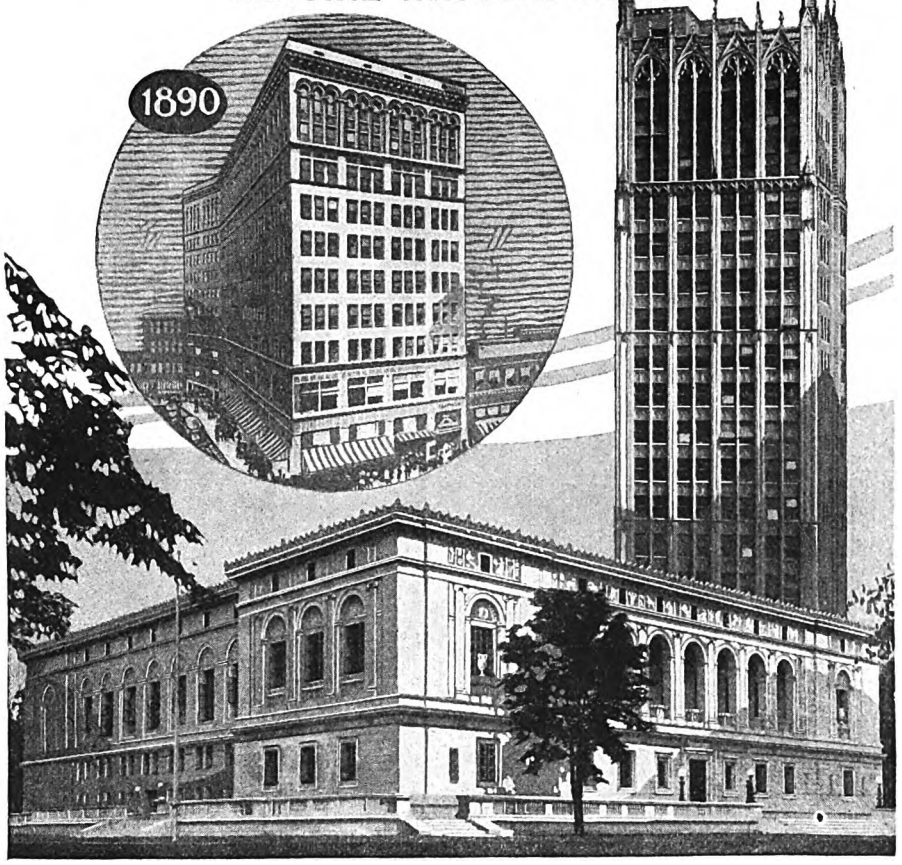
MERCURY MANUFACTURING COMPANY, CHICAGO, U. S. A.

THE TRACKLESS TRAIN

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BYERS PIPE

GENUINE WROUGHT IRON



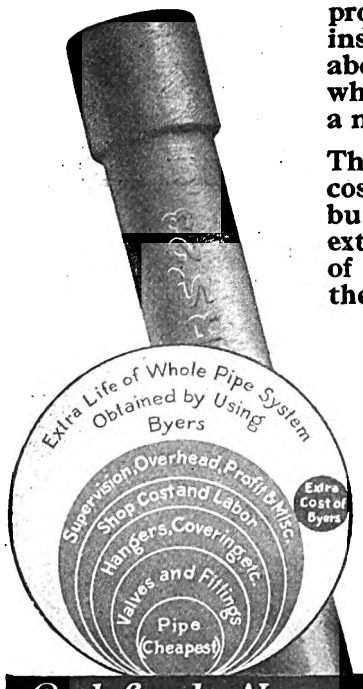
1. *Old Garfield Bldg., Cleveland, Ohio. Erected 1890. Byers pipe in heating system.*
2. *New Public Library, Detroit, Mich. Architect: Charles Gilbert, New York City. Byers pipe installed for plumbing and heating.*
3. *New Real Estate Bldg., Detroit, Mich. Architect: Louis Kamper, Detroit. Byers pipe installed throughout.*

Father Time Passes Judgment

THE rust-resistance of a metal cannot be pre-determined by laboratory tests. Only the test of time and service is decisive. So the metallurgist stands aside, waiting for the verdict of Father Time.

The Garfield Building, Cleveland, erected 1890, shown in circle above, furnishes an example of the long life of Byers pipe which is duplicated wherever Byers was installed years ago. The builders of today, profiting by this knowledge, specify and insist on the installation of Byers pipe above or underground, indoors or out, where the greatest durability is desired at a moderate cost.

The diagram shows the average items of cost in a pipe system. The pipe itself is but a small part of the total cost, and the extra cost of Byers pipe is but 5 or 10% of the total cost of the pipe system. Yet the life of the system depends almost entirely on the rust-resistance of the pipe. For when the pipe fails, the entire investment is lost, and more.



Send for Byers Bulletin No. 38 "The Installation Cost of Pipe," containing cost analyses of a variety of plumbing, heating, and power piping systems.

A. M. BYERS COMPANY

Pittsburgh, Pa. Established 1864

New York Philadelphia Boston Cleveland Chicago Houston

Distributors in all jobbing centers

Look for the Name and Year rolled in every length

AUTOMATIC REGULATION OF BOTH STOKER FEED AND DRAFT

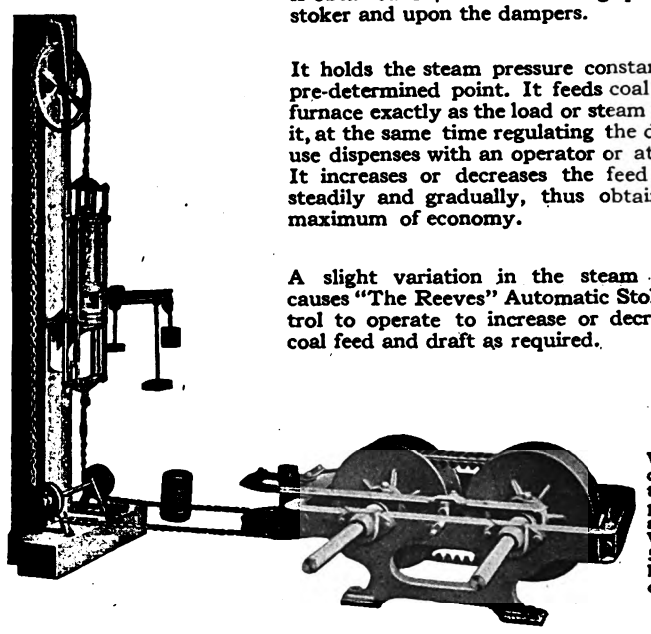
"The Reeves"

AUTOMATIC STOKER CONTROL

is a complete innovation in stoker drives. Through it an entirely automatic regulation is obtained on both the driving speed of the stoker and upon the dampers.

It holds the steam pressure constantly at a pre-determined point. It feeds coal into the furnace exactly as the load or steam demands it, at the same time regulating the draft. Its use dispenses with an operator or attendant. It increases or decreases the feed of coal steadily and gradually, thus obtaining the maximum of economy.

A slight variation in the steam pressure causes "The Reeves" Automatic Stoker Control to operate to increase or decrease the coal feed and draft as required.



We will furnish complete details and blueprints upon application. Write for our 52-page catalog L-44 just off the press.

REEVES PULLEY COMPANY

COLUMBUS, Indiana

Just Suppose--

You had coming to you every month a big bunch of Pictured Progress such as you see in this copy of

INDUSTRY ILLUSTRATED

Wouldn't you give it a hearty welcome?

Wouldn't it put a dash and a sparkle into the daily grind you have always wanted—but which you have found hard to get?

And ***wouldn't*** it be worth to you many times what it costs?

This coupon is for YOU—use it NOW

Engineering Magazine Co.
120 West 32nd Street, New York

SEND ME INDUSTRY ILLUSTRATED every month for a year. I shall remit when your bill comes—sometime within the next thirty days.

Name .....

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ANNUAL SUBSCRIPTION $1

In Canada, $1.25; Foreign, $1.50

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E V I D E N C E

EXPERIENCE is being purchased every day by progressive concerns. Utilizing the experience of others has saved thousands of dollars of expense to shrewd executives who are willing to install in their organizations methods and equipment found efficient and economical by others. Can you afford to ignore such evidence as is presented that

TOWMOTORS

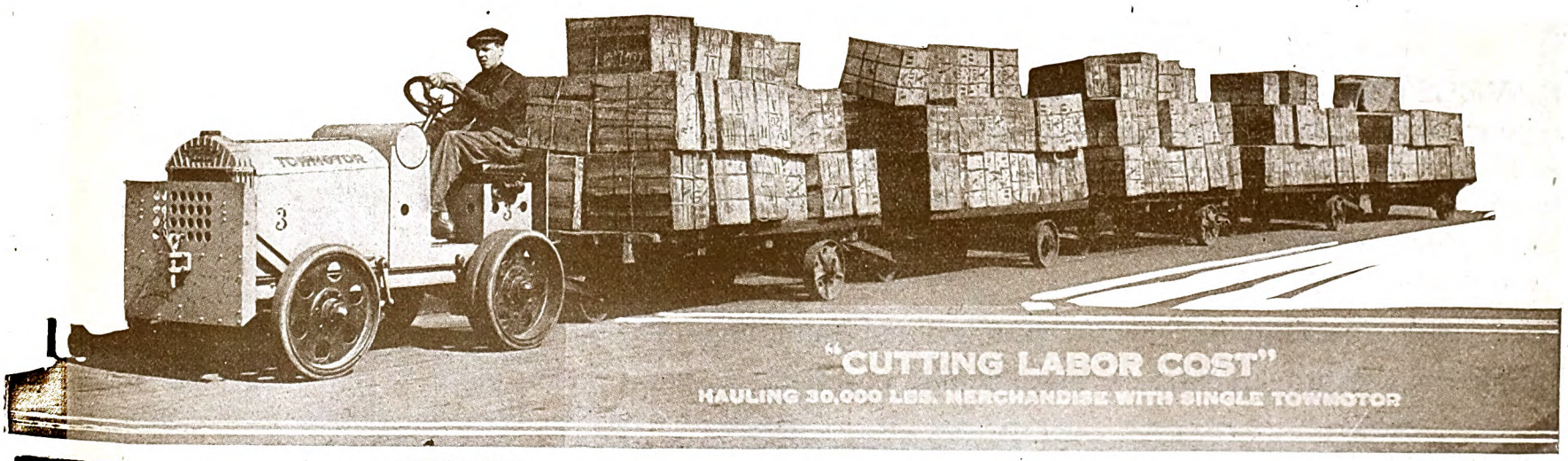
are the most efficient and the cheapest per hour of operation haulage equipment that you can buy?

With such firms as these, **TOWMOTORS** as time and money savers are practically indispensable:

The National Malleable Castings Co., Cleveland, Ohio
Chase Metal Works, Waterbury, Conn.
The Rail Joint Co., Troy, N. Y.
The Wilmington Compress & Warehouse Co., Inc., Wilmington, N. C.
Appalachian Corporation, New Orleans, La.
Chas. F. Felin & Co., Inc., Philadelphia, Pa.
Merritt Lumber Yards, Inc., Reading, Pa.
Norfolk Warehouse Corporation, Norfolk, Va.
The Peerless Motor Car Co., Cleveland Ohio
The Chandler Motor Car Co., Cleveland, Ohio
The Cleveland & Buffalo Transit Co., Cleveland, Ohio
The Newton Steel Co., Newton Falls, Ohio
Henry Disston & Sons, Inc., Philadelphia, Pa.
American Dock Company, New York, N. Y.
The Cutler Hammer Mfg. Co., Milwaukee, Wis.
The Draper Manufacturing Co., Cleveland, Ohio
Rock Island Sash & Door Works, Rock Island, Ill.
Ball Brothers Glass Mfg. Co., Muncie, Ind.
The Mechanical Rubber Co., Cleveland, Ohio
American Steel & Wire Co., Cleveland, Ohio
The Lorain Castings Co., Lorain, Ohio
Kurz Brothers Lumber Co., Chicago, Ill.
The Van Dorn Iron Works Co., Cleveland, Ohio
The Aluminum Co. of America, Massena, N. Y.
Stafford Mayer & Co., Ltd., Port Louis, Mauritius Island
Western Transport Company, Liverpool, England
Christian Fredriksen, Sydney, N. S. W., Australia
H. W. Johns-Manville, Inc., Waukegan, Ill.
Pouch Terminal, Inc., New York, N. Y.
Carnegie Steel Co., Painter Mills, Pittsburgh, Pa.
The Herbrand Co., Fremont, Ohio
The Ferro Machine & Foundry Co., Cleveland, Ohio
United Alloy Steel Co., Canton, Ohio
Endicott-Johnson Corporation, Endicott, N. Y.
Ludlum Steel Co., Watervliet, N. Y.

THE TOWMOTOR COMPANY

1226 East 152nd Street **Cleveland, Ohio**



THE TOWMOTOR

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(Continued from page 69)

following year might help to make the various parts of the organization function better, and would help put the company farther ahead of the game.

One of our favorite pastimes, often indulged in, is to discuss and criticise the Boss and the administration among our fellow employees. Each of us always feel that we could do the whole danged job better if we could have a shot at it. That this is a mere human conceit, arising primarily from a restricted viewpoint and insufficient information, and is quite evident. At the same time this very common attribute possesses possibilities, and can be turned from something akin to a human failing, into an asset. I have heard salesmen, grousing among themselves, discuss peculiarities of the trade, and defects in the products they were selling, that would have solved many of the problems of their superiors had they but had this intimate viewpoint which was open to them, but overlooked as being valueless. Many employees, thinking and expressing themselves thus, *do* think, and their ideas could be made of value. The opportunity to express them would do much—even if it only set them right to find that they were wrong.

Naturally, at the first attempt to gather these ideas and suggestions the result might be quite discouraging. The more discouraging, the greater the index of mental inactivity among the employees, and the greater the result to be hoped for by attempting to cultivate this now unproductive field.

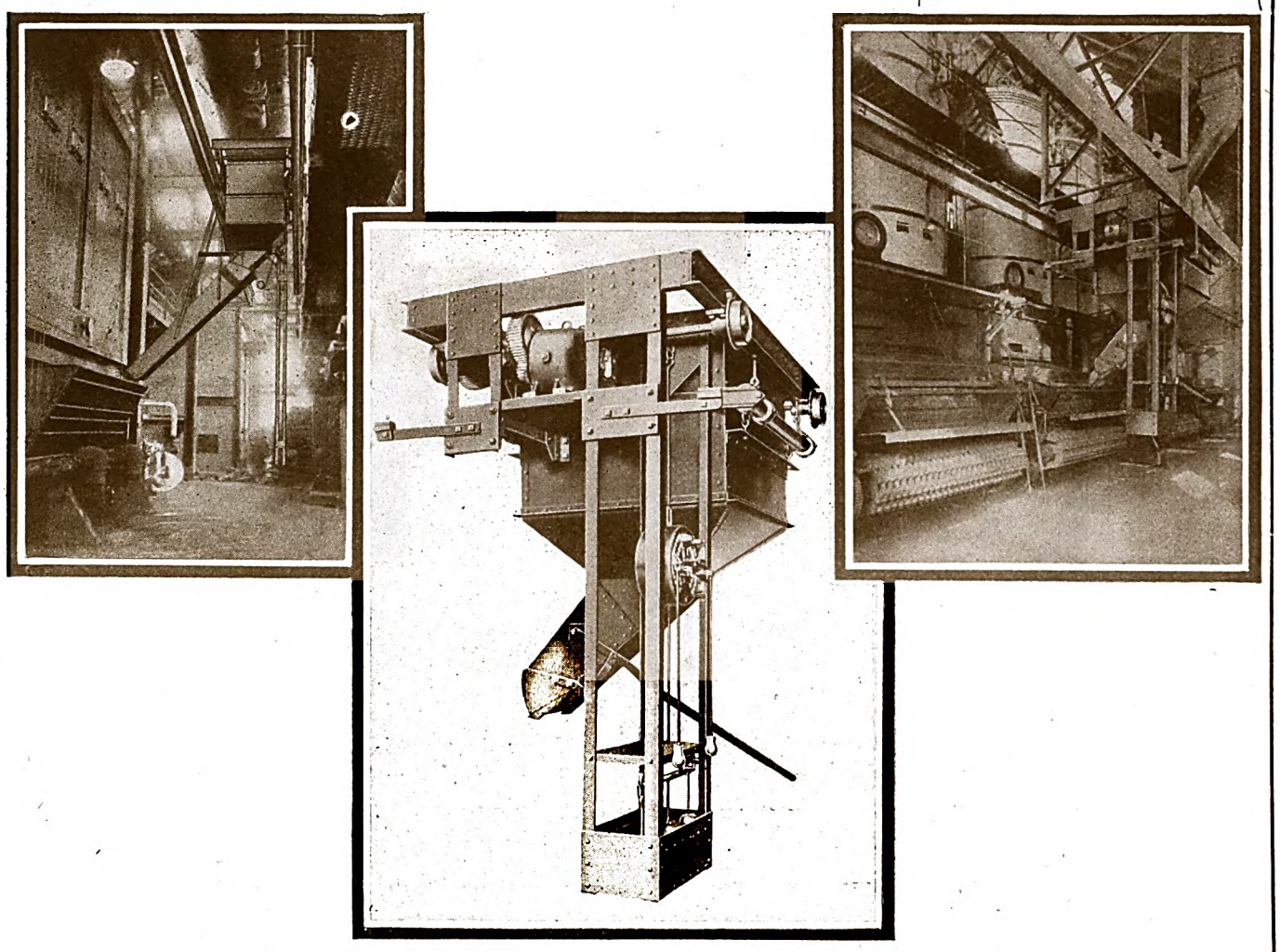
Frankly, the whole thing is a matter of cultivation. Even so substantial and small a thing as a pea will not grow without effort on our part—effort not only in planting, and tending, but even the new soil has to be first inoculated with cultures from previous leguminous bearing soils of the same plant bearing type before any result can be expected.

So it is with the minds we are letting lie idle while we are expecting them of their own accord to grow. A man is hired for the performance of a definite character of work—we overlook the fact that the work he does may be but a fraction of the work he is capable of doing, or would like to do. We let him do his work in his own way as only his own limited resources permit—with a little help he might do it a dozen times as well. We look upon the wastes he permits as faults to be corrected by the elimination of the wastes—we cure the effects and never seek the cause behind them all by attempting to train *his* mind to see all the possibilities of his job.

As with the average individual, this is no self-starting, general proposition. It calls for work that will never cease, any more than any other of the important functions of production will ever cease. It is something to be planned with skill, and perhaps cunning; it will cost time, money, and effort. But it would be the beginning of a new era in the efficiency of endeavor.

And why, after all, should not some money and time be spent in this quarter? There appears to be a huge unbal-

(Continued on page 36)



AN IMPORTANT LINK BETWEEN THE COAL BUNKER AND THE STOKER

A WEBSTER WEIGH LARRY in your boiler plant will enable you to keep an accurate dependable record of the amount of coal which passes from the coal bunkers to the stoker magazines.

Webster weigh larries can be installed in your power plant to serve any number of boilers as they are built either hand propelled or motor operated with capacities ranging from 500 to 5000 pounds.

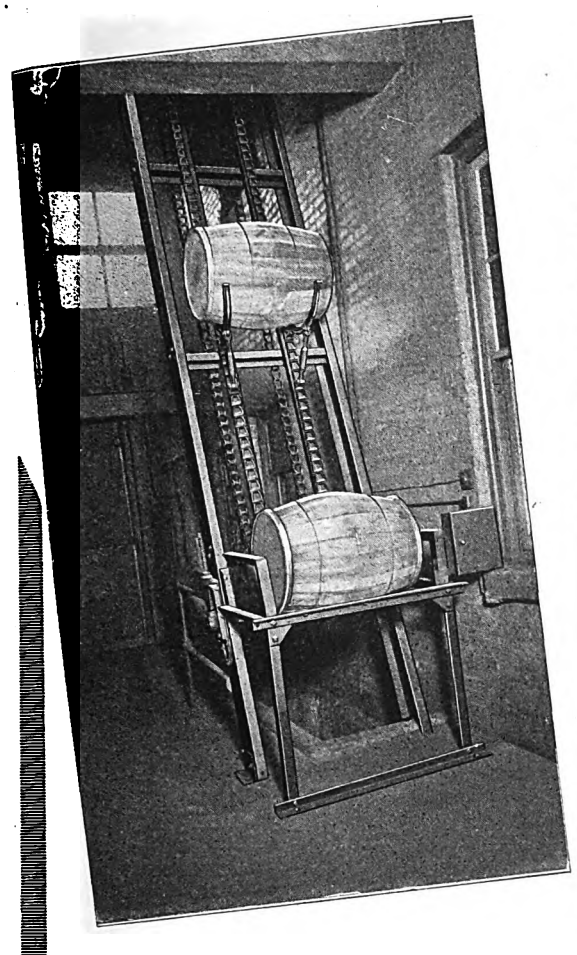
Let our engineers analyze your coal and ash handling method to determine what improvements are possible and practical in your boiler plant.

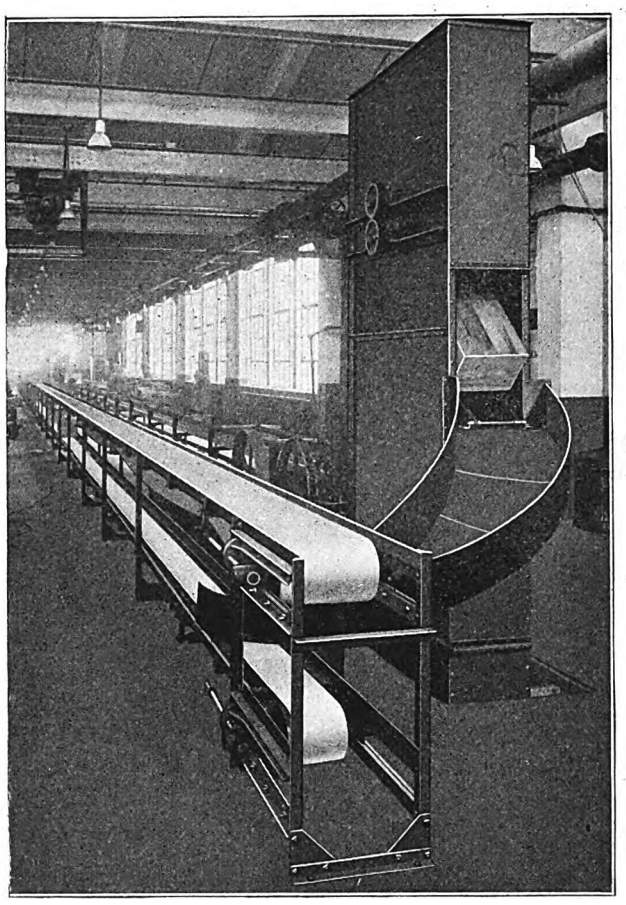
THE WEBSTER MFG. COMPANY

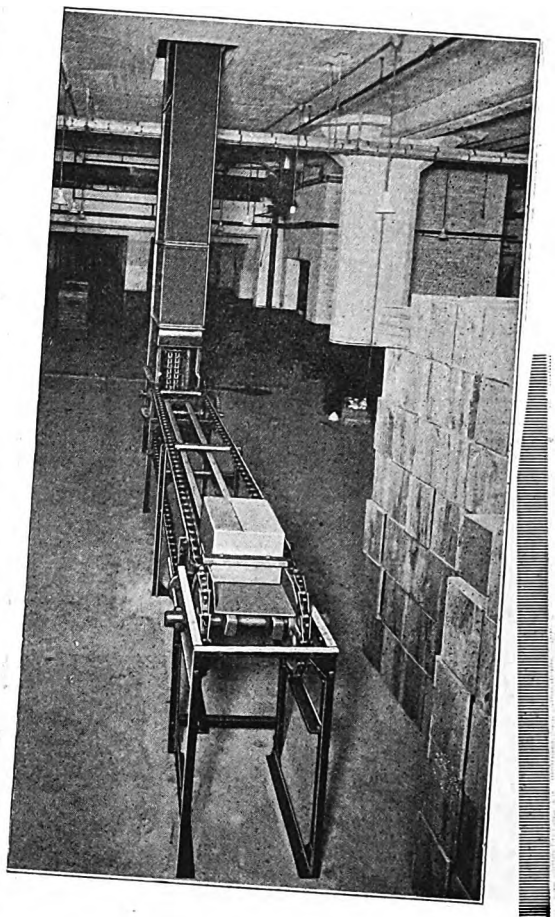
4500-4560 CORTLAND ST., CHICAGO

Factories Tiffin, O. *and* Chicago-Sales Offices *in* Principal Cities

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Survey Your Plant Through The Eyes of Your Competitors.

SYSTEM immediately becomes the mooted question. True, productive machinery, such as machine shop equipment, mixers, looms, filling machines, etc., is practically standard. The equipment of this class that they have you have. But are you keeping your materials on the move so that all machines are producing constantly. That's the biggest factor of business today. And to keep products in the various stages of manufacture on the move you must use Conveying Systems.

Conveying Systems eliminate manual handling of materials, waste motion, keep operators supplied continuously with work, establish a working pace for employees thereby controlling production and carry finished product to stock room or shipping department. *Just what would a Conveying System mean to your business?* A greater production with present payroll which means increased sales and more profits.

Conveying systems to function properly must be designed to meet your requirements. To determine your needs an analysis must be made of your methods of manufacture which involves study of operations, routing of materials, determining maximum production and the securing of necessary data from which a Conveying System which will keep materials on the move in your plant can be designed.

We will gladly have one of our representatives call so that this matter can be discussed to your entire satisfaction.

SAMUEL OLSON & CO.

Loose, Bulk and Packed MATERIAL HANDLING SYSTEMS

2418-26 Bloomingdale Ave.
CHICAGO, ILLINOIS

5th Ave. Bldg.
NEW YORK, N. Y.

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(*Continued from page 66*)

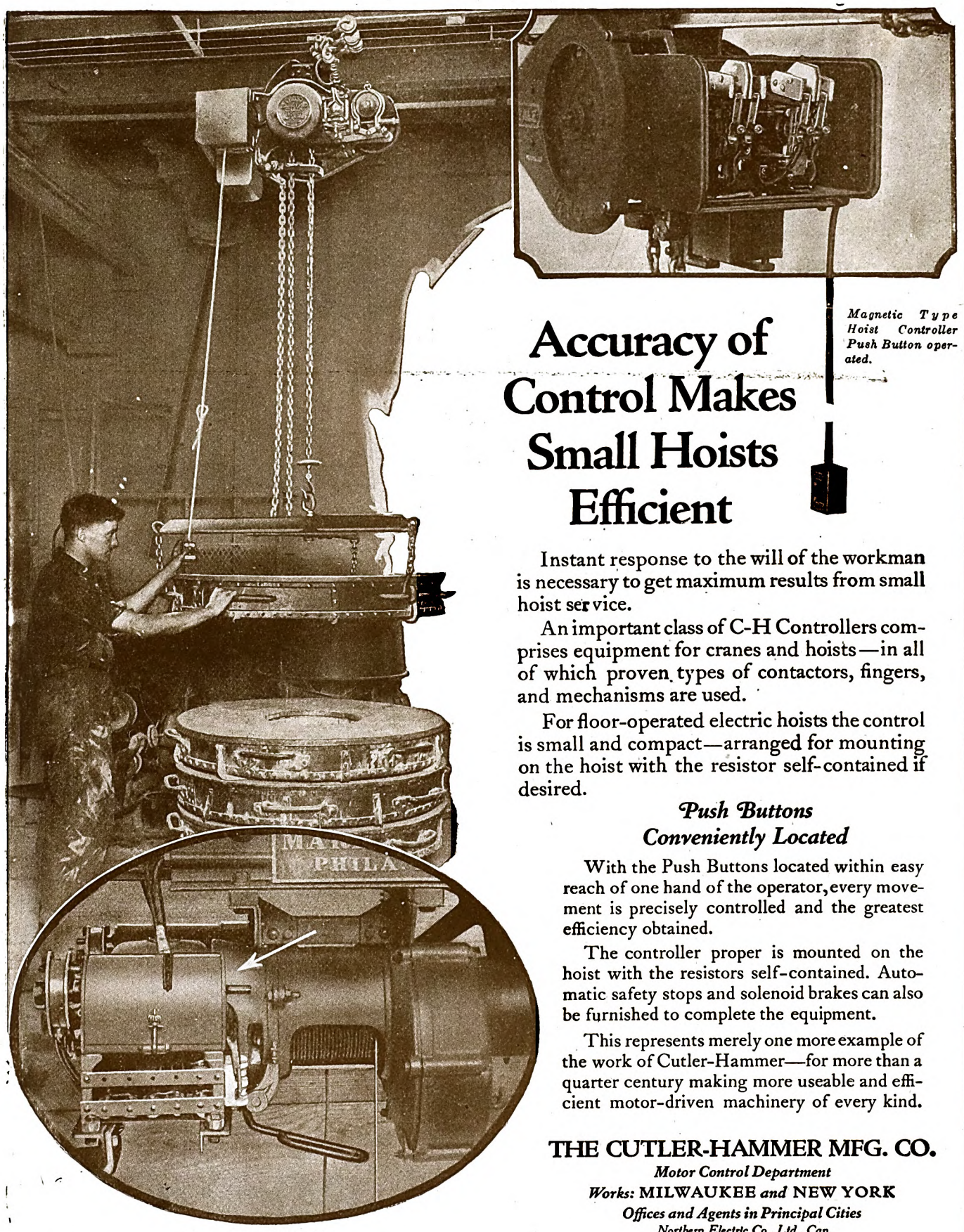
ance, somewhere, when the two extremes of an organization, the officers and the workmen, are the recipients of so much attention and benefits, while the in-between group, the actual executives if not the originators, gets only its minimum wage. Lockers and shower baths, schools and community houses, homes, hospitals, bonuses, and a horde of other extras seem to be ungrudgingly authorized for the workmen. Yet foremen, clerks, accountants, stenographers, junior and minor executives, and all other great army of white-collar workers have but their straight salaries to look to for both the extras and the necessities of life. Is it because the one class has been sorted into producers, and the other into that ogre, overhead, which permits the pampering of the one, and the apparent disregard of the other? If this be the reason, it is time they be given the opportunity, the means, and the incentive to improve themselves, and their jobs by the use of their generally so uncalled upon mental resources. Why wont the one expenditure be as profitable as the other? How many organizations encourage this middle group to prepare themselves for advancement? How many emphasize to their clerical and junior staffs that there is scarce a good sound man at the top of anything who has not spent much of his time in study and in preparing himself for larger opportunities? Of course they can find these things out for themselves. But how many are *made* to find them out—or rather made to *want* to find them out?

You district and general managers, officers and directors bewail the woeful lack of constructive thought, initiative,, and judgment, crying, "Why don't they grow something besides sapheads, these days!" —not realizing that the "they" is *you* and that you have no more right to expect ability to spring full-clad into your executiveships than you have to hope that the tons of ore you haul into your plant as raw material will turn overnight into steel, and the next day into finished, operating machinery.

And now a little more as to methods.

We are to make some effort which will be equivalent in result to requiring that each of our employees—and *all* of them—submit once a year a written opinion t o u c h i n g briefly on criticisms of his own work, his departments, and that of the entire company, as he sees it; with suggestions on all three. These opinions will come forth reluctantly, at first, and with effort. They will even be largely useless, being, so to speak, half-baked. But the very knowledge during the course of the year of the necessity of rendering such opinions will engender a closer observation of all that goes on around each man. He will develop the habit of judging, weighing, and classifying as good or bad, every important act or policy he observes, cultivating first analysis, and then judgment. And these two qualities, particularly developed in connection with the peculiar work of the company, will be an irresistible leaven. Each man

(*Continued on page 76*)



Magnetic Type Hoist Controller Push Button operated.

Accuracy of Control Makes Small Hoists Efficient

Instant response to the will of the workman is necessary to get maximum results from small hoist service.

An important class of C-H Controllers comprises equipment for cranes and hoists—in all of which proven types of contactors, fingers, and mechanisms are used.

For floor-operated electric hoists the control is small and compact—arranged for mounting on the hoist with the resistor self-contained if desired.

Push Buttons Conveniently Located

With the Push Buttons located within easy reach of one hand of the operator, every movement is precisely controlled and the greatest efficiency obtained.

The controller proper is mounted on the hoist with the resistors self-contained. Automatic safety stops and solenoid brakes can also be furnished to complete the equipment.

This represents merely one more example of the work of Cutler-Hammer—for more than a quarter century making more useable and efficient motor-driven machinery of every kind.

THE CUTLER-HAMMER MFG. CO.
Motor Control Department
Works: MILWAUKEE *and* NEW YORK
Offices and Agents in Principal Cities
Northern Electric Co., Ltd., Can.

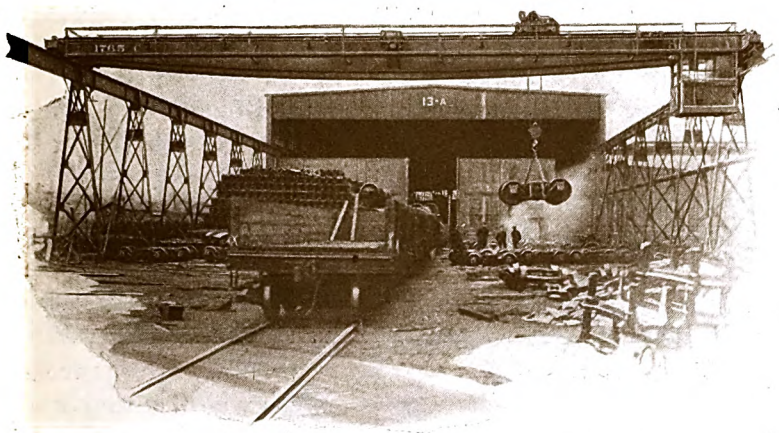
Drum Type Hoist Controller, operated from floor by ropes.

C-H CUTLER-HAMMER

SMALL HOIST CONTROLLERS

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NILES CRANES



Save time—Save labor—Save space with modern crane equipment

THIS CAR MANUFACTURER wanted a crane to do double duty —inside and out—one which could be depended upon under all weather conditions. Quick, orderly transportation of trucks, car bodies and the many lighter parts that go into the assembly of a car was paramount. To fill these specifications Niles Cranes were chosen.

The years of satisfactory service since installation justify this choice.

For the Steel Mill Rolling Mill, Foundry, Shipyard, Quarry, Mine Yard, Locomotive Shop, Forge Shop, Central Station and wherever heavy materials must be handled with speed, safety and economy.

Niles Cranes are famous for their strength and reliability. They are made in sizes up to 250 tons capacity and larger. We also build Jib Cranes, Gantry Cranes, Wall Cranes. There is a right size and style for you no matter what your needs.

NILES-BEMENT-POND CO.
111 BROADWAY — NEW YORK CITY
CRANE WORKS— PHILADELPHIA, PA.

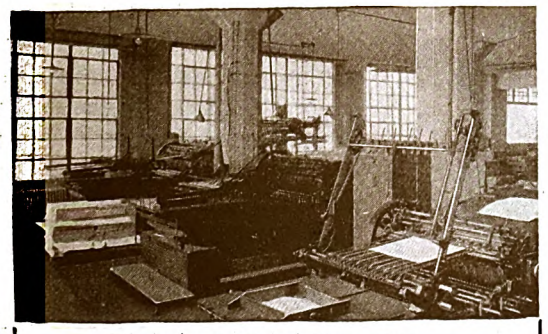
No. 1 *of a series illustrating the many industries served by Niles Cranes.*

BLU-EE

TRADE-MARK

For Your Windows—Means Better Work

Filters out the Heat and Glare



What BLU-EE Users Say

We wish to state that we are very much pleased with our use of "BLU-EE" and find that it eliminates the glare without the necessity of placing window shades.
BROWN-LIPE-CHAPIN CO., Syracuse, N. Y.

We use BLU-EE on our windows to minimize the sunlight, and it answers the purpose splendidly, without keeping out the breeze; whereas, awnings would cost considerably more and keep out the breeze.
AMERICAN SNUFF CO., Memphis, Tenn.

"Glaring light is a menace to the workers and retards production. The ideal light is a soft, cool light made by the sun's rays with the glare and heat cut out.

BLU-EE keeps out the rays below the blue line in the spectrum--rays that give the heat and glare to the sunlight. Those above the blue line penetrate unhindered and the result is a diffused, filtered light, restful to the eyes and gives the worker a chance to do better work.

BLU-EE is easily applied; simply dissolve in hot water, allow to cool and apply to the windows with a paint brush. It will not rub off but can be easily removed with warm water.

We want to prove what BLU-EE can do in your plant. Try some at our risk. Fill in the coupon below and send it in at once.

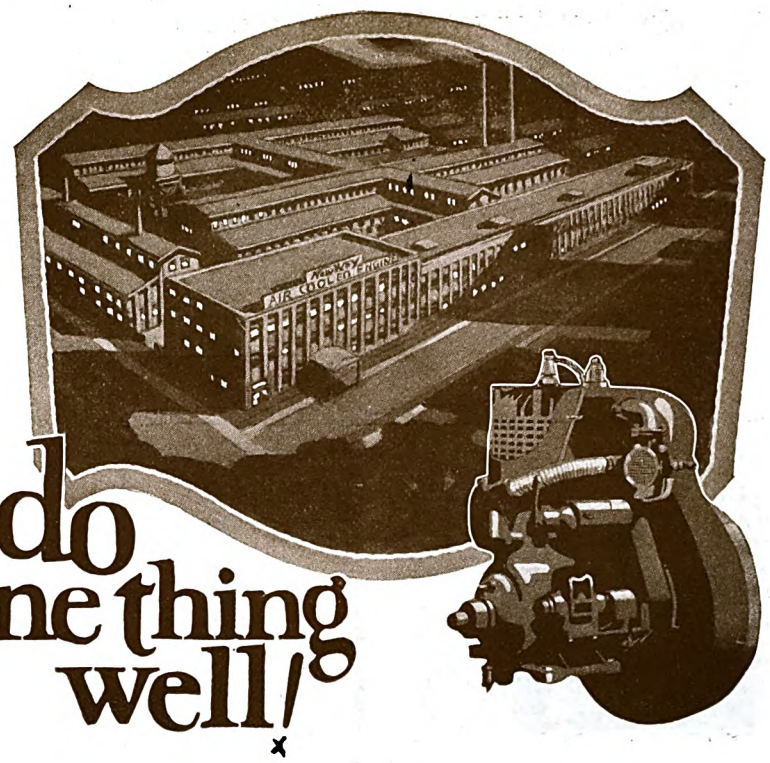
PARK CHEMICAL COMPANY
3822 Edwards Road **Cincinnati, Ohio**

Try It Out—We Run the Risk

PLEASE send me 2 packages of BLU-EE, sufficient to cover 2000 square feet of glass. It is understood that I am to use one of the packages as directed and will remit $5.00 for both if I am satisfied with BLU-EE, and if not entirely satisfied may return the other within thirty days and you will cancel this order.

Firm Name..... Position.....

Your Name..... Address.....



do one thing well!

THE "New-Way" could not be sold within anywhere near its price, nor made of as high quality materials and workmanship if our immense factory and skilled corps of workers did not devote their entire time, energy and ability to producing but one type and size engine.

don't be misled

The "New-Way" is not to be compared with any other gasoline engine. For conveyors operating under very dusty and dirty conditions there is no engine or electric motor that is so well protected as the "New-Way." All wearing and moving parts are enclosed and operate in a bath of oil. Being throttle governed and Bosch Magneto equipped gives a steady flow of power, even better than an electric motor because it can be used anywhere and everywhere, whether electric current is available or not. Being air cooled it will operate continuously without overheating or freezing. It "Goes and Goes Right" in any climate.

If *you* have a power problem, let us help you work it out. It incurs no obligation on your part. A letter will bring our traveling engineer to your office.

Write for Circular C-23

THE "New-Way" MOTOR COMPANY
LANSING, MICHIGAN, U.S.A.

Eastern and Export Office
Woolworth Building New York

The Air-Cooled, Multi-Purpose
"New-Way"
5 Engines in 1

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(*Continued from page 74*)

would see himself and his work in relation to both his immediate contacts, and their broader aspects and applications. He should develop, if not a big, at least a better detail and a better general point of view. A combination as rare as it is valuable.

After all, it is simply imagination that is to be developed. The little fellows can be taught to work with fictitious figures and people and conditions. They can be made to imagine situations and difficulties that might, but do not necessarily exist, to the end that when they have their real concrete problems, they can have this mental reservoir upon which to draw. They can acquire the power to visualize, to see non-existent things as clearly as if they did exist—clearly enough to follow their workings in detail through the maze of resulting changes and effects its application would have, and to be able to come close to the final answer without having to actually try out the scheme. Though this is real imagination of the simplest sort, it is not easy of accomplishment for unaccustomed minds. But no one gets anywhere above the execution of the detailed instructions of others without its use. No new trails are blazed, nothing of either abstract or material worth is ever accomplished without something considerably more than its casual cultivation and employment.

Men like to express themselves whether they know what they are talking about or not. Our job is to get them to know some things well; to be awake to what is going on around them, to get them to express what they see in their work, as well as what should be there that is not there, and then to do their work *some* percentage better. But it is always up to the employer to keep them awake. For men not only need a stimulus, they react powerfully to incentive. If they are to produce more, they must be given more. This, as a fundamental, is the rock upon which many attempts at getting better coöperation and a better degree of endeavor fail. It is too often made a one-sided proposition of give all for the benefit of the company, with no additional benefit to the givers. Within the limits of the individual, it is almost an axiom that the more he is given, the more-more-more he will produce. Which does not by any means mean just paying more in dollars and cents, but as much in giving stimulation, larger responsibility, inspiration, and the *opportunity of qualifying* for a greater monetary return.

If we can accomplish this idea of getting each employee at least once a year to tell us what he is thinking, we will get his viewpoint from the angle which most appeals to him. The expression of his ideas will show the line along which he is most interested, and hence most qualified to work, providing for a better fitting of the man to the job, with resulting increased efficiency. In the administrative departments, exactly square pegs do not long remain in exactly round holes. The obviousness of the mistake in such extreme cases soon shows up the error. The true misfit is when a very nearly round peg is jammed



Fig. 627

Leading Firms Have Endorsed

MEECO

ICE-COOLED DRINKING FOUNTAINS

The Carnegie Steel Co. have 85 MEECO Ice-cooled Fountains, Cheney Bros. have 165 Dodge Bros. have 100, Fore River Shipbuilding Co. have 70, The National Tube Co. have 60, Pratt & Whitney Co. have over 50, Remington Arms Co., 120, U. S. Government departments have over 500, and the U. S. Steel Corp. 200. Many other concerns have from 25 to 50. There must be reasons. And there are. MEECO Fountains fulfill every requirement of modern usage. They are absolutely sanitary. They will stand up under the hardest kind of wear and tear. They are practical, efficient and fool-proof. Moreover they take up but little floor space, are easily installed and are pleasing in appearance. Their first-cost and up-keep is extremely low.

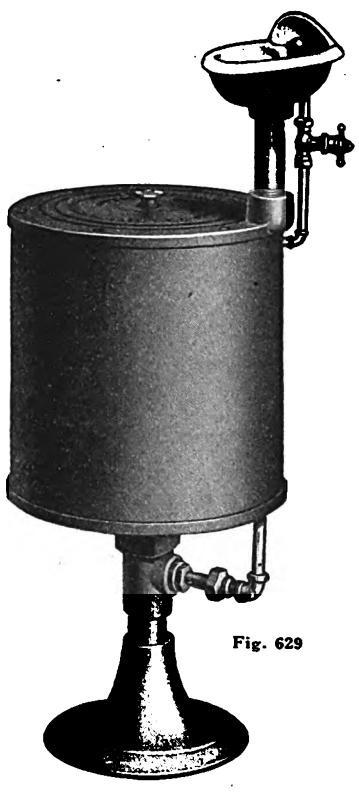


Fig. 629

On this page are shown but 3 of the 14 types of MEECO Drinking Fountains which have been designed to meet every possible requirement. MEECO Fountains are engineered, not merely manufactured. Catalogue, diagrams and price list will be gladly sent on request. Just address, DRINKING FOUNTAIN HEADQUARTERS, Framingham, Mass.

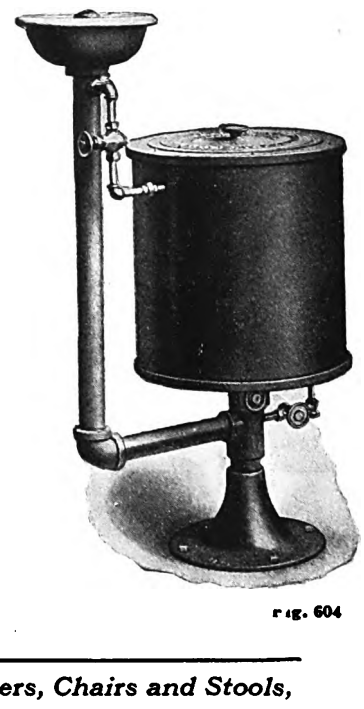


Fig. 604

A Few Representative Companies Who Are Using MEECO Drinking Fountains:

American Sheet & Tin Plate Co.
American Steel & Wire Co.
American Sugar Refinery
Baldwin Locomotive Works
Barber Asphalt Paving Co.
Bethlehem Steel Co.
Billings & Spencer
Boston Elevated R. R. Co.
Buick Motor Car Co.
Calumet & Hecla Mining Co.
Carr Fastener Co.
Celluloid Company
Champion Ignition Co.
Colgate Co.
Duluth & Iron Range R. R. Co.
E. & T. Fairbanks Co.
Fellows Gear Shaper Co.
Fisk Rubber Co.
Robert Gair Co.
General Electric Co.
Gilbert & Barker Mfg. Co.
Gillette Safety Razor Co.
Godell Tool Co.
Gray & Davis
Greenfield Tap & Die Corp.
R. Hoe & Co.
Hyatt Roller Bearing Co.
Ingersoll-Rand Co.
International Harvester Co.
Jones & Laughlin Steel Co.
Kellogg Toasted Corn Flake Co.
R. K. LeBlond Mach. Tool Co.
Lever Bros.
Link Belt Co.
Lodge & Shipley Mach. Tool Co.
Lowell Bleachery
Ludlow Mfg. Associates
Marvel Carburetor Co.
W. H. McElwain Co.
Mergenthaler Linotype Co.
Miller Lock Co.
Geo. H. Morrill Co.
National Shawmut Bank
National Zinc Co.
N. E. Confectionery Co.
New London Ship & Engine Co.
Nordyke & Marmon Co.
Oneida Community
Packard Motor Car Co.
Panama Canal, Purchasing Dept.
Plymouth Cordage Co.
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o an oval hole, or a small are one into a triangular-e—when a man fits in some the essentials, but lacks in less obvious, but frequently portant ones. For it is a monstrable fact that men of erage or higher ability can many things well, and a od many things exception-y well, without over hitting t one thing they can do so ch better than they can do the others, and in which y would be the most inter-ed and do the best work. nce the value of anything t will really indicate their tural bent.

Not counting one's harmless d diverting hobbies, there is tle excuse for a man's ha-ng a vocation *and* an avoca-n—one kind of endeavor for s living and work, and an-er for his pleasure. The lat-field is the one in which his eatest success would lie had developed himself to do well e thing he most enjoyed do-. I say there is little ex-se. There is under present nditions much excuse. But ere is little reason or justi-ation for the extent to which e present manner of the ad-nistration of business per-ts the undevelopment of the lents which lie dormant in so any of those who are just lpers in the administration business.

For further aid, in order at the achievements, labor ving methods, and discover-s of others may be used to e best possible advantage, a story and library of one's n and associated industries, st and contemporaneous—oks, and especially current agazine articles—should be ailable. They should be used all executives, and those in position to become even inor executives. House or-ns, in large organizations, e a great opportunity and ctor in this development. Be-des being a medium whereby e management can get to the dividual, they provide a path hereby the individual can get the management, affording ose who contribute to it a ance to show themselves art from their specific jobs. here they are possible, I do t believe it to be too much of requirement to insist upon a ntribution at least once a ear by every man above speci-ed grades in the organization, and these contributions scheduled, willy-nilly, and printed. The poor ones will not be as good as the good ones, but they will all improve, with corresponding improvement in the writers and their work.

One other important thing in this developing process. Do not delegate detail; delegate results. Give the man a chance to think. Make it necessary for him to think if he would hold his job. Be tolerant at first, naturally, and help him if necessary in finding out how to think, where to get his ideas, and how to get results from them. If time does not bring results—he is in the wrong place. But be sure his failure be not as much your fault as it is his own!

It may be said, of course, that it is all right to talk about these things that are so largely a matter of education, but that they should start in the primary schools. That it will take a generation to get results; and that we are interested in today's work, and today's results. Well, we can't begin

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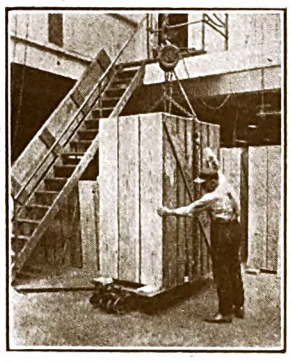
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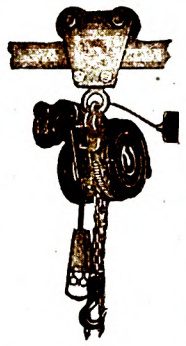
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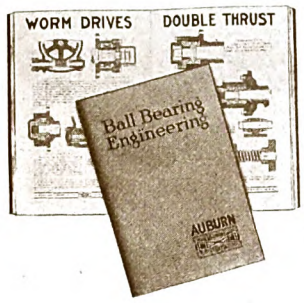


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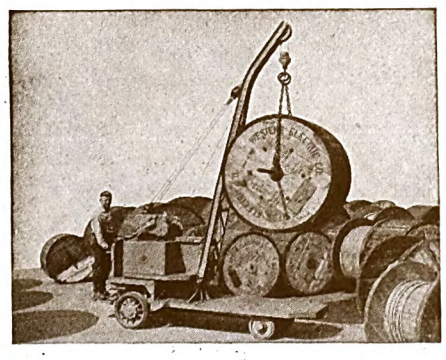
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yesterday, that's certain. And it can't be done overnight. It is the long time game that wins and pays when it is well and intelligently played. If we are willing to play it that way, results can be had—if we start with ourselves and the man next to us, and see that he does likewise.

As for the matter of education—there is much in that. The schools and colleges of our time can be said to make a fair attempt to scratch into the vast mental resources of the world; to make a real effort to awaken it. But the great indictment of our institutions of learning, or what more aptly should be applied to the attitude of our times, is that there is a well defined conception that the mental work of the student can end with his schooling, and particularly with his college work.

There is a great but seemingly most unrecognized need, for teachers of the fact that all life is a course of study. That particularly the field of human endeavor needs its participants to ever and constantly be studying and searching today, to meet the needs and problems of tomorrow. That the text book of school and college but gives way to the technical, business, biographical, historical, and inspirational publications of the doings and thoughts of the leaders of yesterday and today. It must be emphasized that study never means the mere committing to memory of so many pages of an assignment. It is the search for information along a given line, the application of that information to the problem or aim in hand, with the resulting intelligent solution, or a new light upon a given phase of endeavor.

Education is literally but a leading forth of hidden talents. The student does himself and society an injustice when he seems to concede that with the obtaining of his degree, there is nothing more to be led forth—that his mind will go on growing, or be prepared to meet the demands of tomorrow by what he learned, with the comparatively little training he had, in the schools of yesterday. The graduate should be made to realize that his rise above the average of the world, depends, in addition to the use of the natural qualities that go to make up character, very largely upon the degree with which he bolsters up his own limited experience and knowledge by the already tried out and proved experience of those who have previously trod the almost identical paths before him.

This is not to imply that these things are not done today. There are those of initiative and ability and the faculty for hard and continued work who already use these aids to progress. One gratifying illustration is the current tendency to establish schools for the training of foremen in numbers of our manufacturing plants. But even they are all too few, and reach only a portion of the possible field.

Also, the number, quality and worth of the correspondence schools, university extension courses, and the wealth of trade and technical journals which seem to find such a ready distribution, argue that there is not only an accepted need for these continued types of help in the world, but a real use of them. But these efforts at group and self help are all too limited. Too few realize that aid in the solution of almost any problem can be found in print, and that one of the first things to be done upon facing the necessity of doing anything upon which the dependent hath insufficient knowledge, is to dig up what published information there is available. Books and magazines, government reports and statistics, the memoranda and proceedings of technical societies and trade associations—even the usual wild prospectuses of those eager enthusiasts, the local Chamber of Commerce, or Boards of Trade—all have value as a source of special information and help.

The general acceptance of these most vital principles will not endanger those who already use them, and aspire to the planes their use will bring. It will but raise the general standard of human activity—bring that sixty-five per cent. up to seventy-five per cent. or maybe eighty-five per cent., possibly make that the average of human endeavor. Those who are harder workers, have more than the average in initiative and ability, will still find wide fields in which to work. They will find also that the hu-

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ian tools with which the leaders and executives of the world ave to work are sharper, arder, and more powerful; nd that they will have quicker nd better aid in carrying out eir plans and ideas. The efiency of the individual in inustry will be raised by some ppreciable percentage—and ar preventable wastes lessen-l by just that amount.

Additionally, we will be doing our part to offset the meanicalizing tendency of the mes by teaching the art of eation, and by furnishing a productive use for some of the spare time that modern efficiency makes so prevalent—time that often hangs heavily on the hands of those who have neither been trained, nor ever suspect that there is a pleasant, even a profitable use for it. Finally, we manufacture not only our mechanical product——*we become builders of men,* either of ourselves, or of others.

We are richer—have mined our wealth from within ourselves, and can never be so poor again!

Pitfalls of Employment Contracts

By Leslie Childs

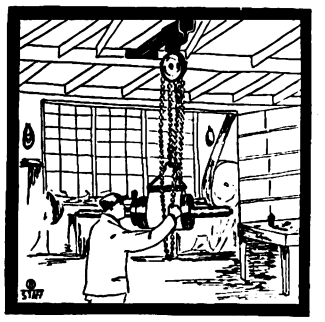
[T goes without saying, that the factory executive, charged with the responsiility of entering into conacts of employment with killed or professional emloyees, should exercise care drawing the terms of such greements. This is true beause, contracts of this kind ay involve the payment of a arge sum of money in the ourse of their operation, and so loosely drawn or ambiguus in their terms as to lead to fter dispute and litigation, ay result in a material loss one or both of the parties ereto.

Contracts of this kind may e formal, which is perhaps he safest method to follow as ey are more apt to express learly the intentions of the arties, or they may be created y an exchange of letters, or ven orally. However, in any vent, there are certain points hat should be clearly undertood, such as the salary, the erm of the contract, and the nethod by which it may be terminated, if possibility of after dispute is to be reasonably avoided.

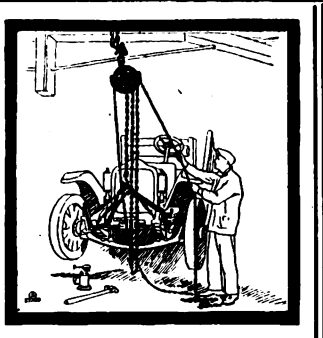
Of these points perhaps the one most frequently overlooked has to do with a clear statement of the time such a contract has to run. Not infrequently this point is left hazy, perhaps dependent upon the statement of the salary or other stipulations, and, unless the contract is terminated to the satisfaction of both parties, may form the basis of after dispute and perhaps costly litigation, that might have been avoided by the exercise of care in the beginning.

An excellent illustration of this danger point to the factory executive, when entering into contracts of employment, appears in the recent Michigan case of Loew *vs.* Hayes Mfg. Co., 188 N. W., 360. The case turned upon the construction of the salary clause in the contract, relative to its inference as to the time the contract had to run, and the outcome is very convincing of the importance

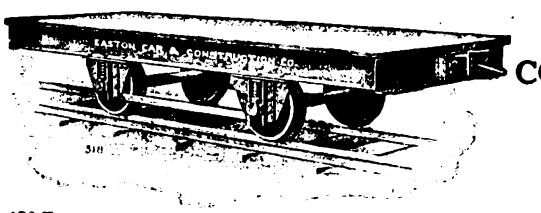
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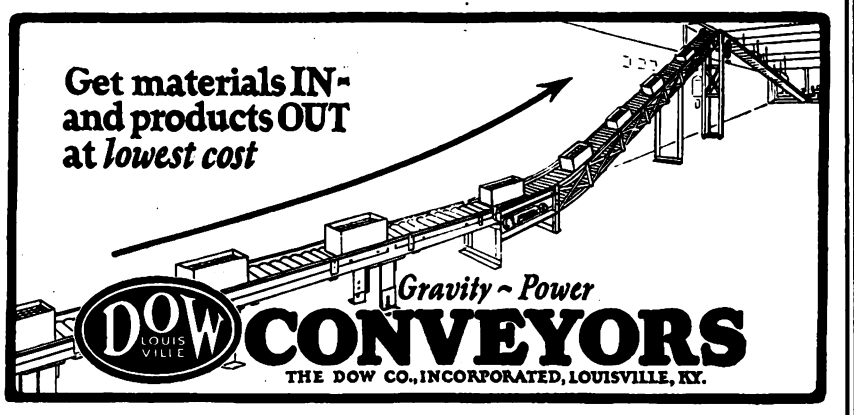
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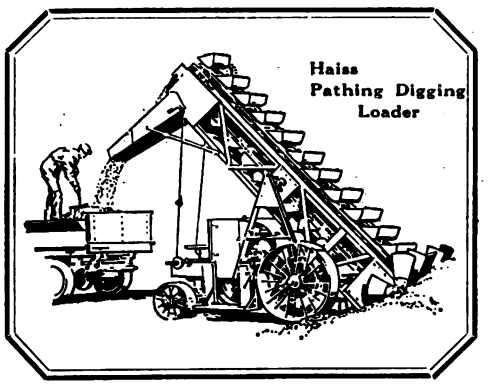
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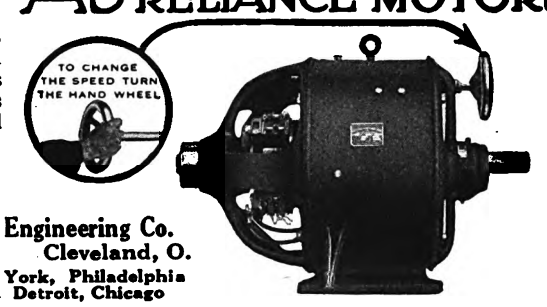
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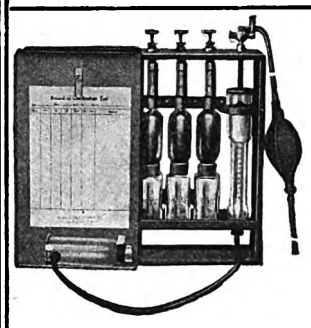
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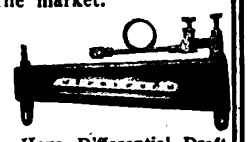
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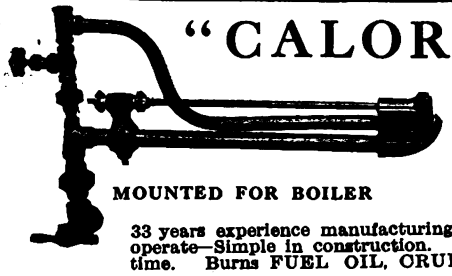
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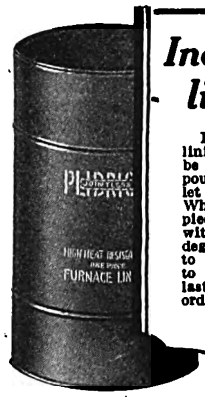
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of a positive statement in such contracts in respect to their duration. The material facts, as taken from the report, were as follows:

The plaintiff had, it appears, been negotiating with the defendant relative to his employment. Thereafter the defendant wrote him a letter which, among other things, contained the following offer of employment:

"As per our conversation yesterday we will agree to employ you at the rate of six thousand dollars ($6,000.00) the first year, sixty-six hundred dollars ($6,600.00) the second year, and seventy-two hundred dollars ($7,200.00) the third year—same payable monthly in case you decide to come with us.

"Your work will consist generally of tool designing, special machinery, engineering and other things pertaining to your line of work, and no doubt can be of great assistance to us in our sales department in obtaining new business.

"In other words, I feel that you should be a 'free lance' to be at the service of the writer, and it might be necessary to occasionally visit the Hayes Ionia factories at Grand Rapids and Ionia, Michigan, on some consultation work, etc.

"I trust you will be in a position to accept our offer, and, awaiting your reply, remain

"Yours very truly, Hayes Manufacturing Company, (Signed) H. J. Hayes, Ass't to President."

The plaintiff accepted the above offer of employment in writing and entered upon the duties of the position January 3, 1918. He continued in the employment until June 13, 1918, when he was discharged. Thereafter he brought the instant action for damages, on the theory, it seems, that he had been employed for a period of three years, and that his discharge had been wrongful.

At this point it is worthy of note that the letter of the Hayes Manufacturing Company, quoted from above, offering the plaintiff employment, contained the whole contract of employment. This letter, it will be noted, did not specifically state the period of employment, but it did state that the plaintiff would be paid "at the rate of" so much for the first, second and third year. Upon the discharge of the plaintiff then, about five months after he had entered upon his duties, this phase of the contract became the basis for a serious dispute:

Contentions of the parties stated.

The plaintiff, as has been noted, contended that his employment was for a period of three years, and that he had been wrongfully discharged. The defendant, Hayes Manufacturing Company, took the position that the employment was for an indefinite period of time, and that the stipulation as to the rate did not contemplate a definite employment for three years, but was merely a statement of the salary the plaintiff was to receive providing he remained with the company three years, and that it had the right to discharge the plaintiff at any time.

Upon the trial of the cause in the lower court, the plaintiff recovered a judgment against the Hayes Manufacturing Company for $8,200. An appeal to the Supreme Court of Michigan was taken and here the defendant, Hayes Manufacturing Company, in stating its contention as to the construction to be placed upon the contract as to time, among other things, said:

"The contract states that the plaintiff is employed 'at a rate' of compensation. It does not state that he is employed for one year or any other period. The company does not agree to pay him this compensation for each of the three years mentioned, but at the rate of certain yearly amounts for each of the three years in case he is there. An increased scale is provided for in case the plaintiff remains, in the defendant's employ during the periods mentioned. It is a contract fixing the rate of compensation, but not fixing the term of employment."

In passing upon this contention the court reviewed several decisions from other states and noted that there was some conflict in the authorities. It however, declined to accept the construction offered by the Hayes Manufacturing Company, and in stating its conclusions, on the meaning of the

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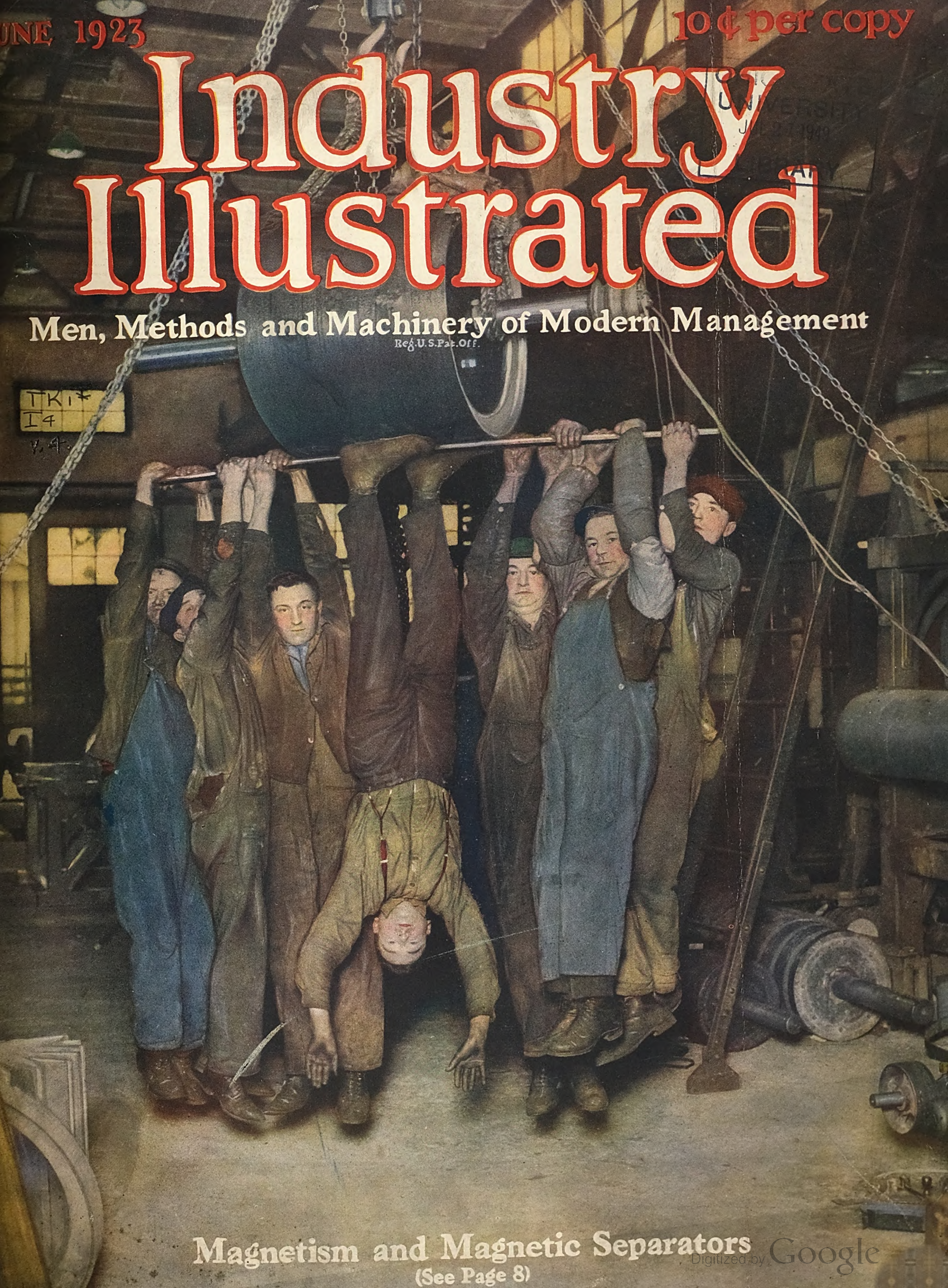
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Magnetism and Magnetic Separators

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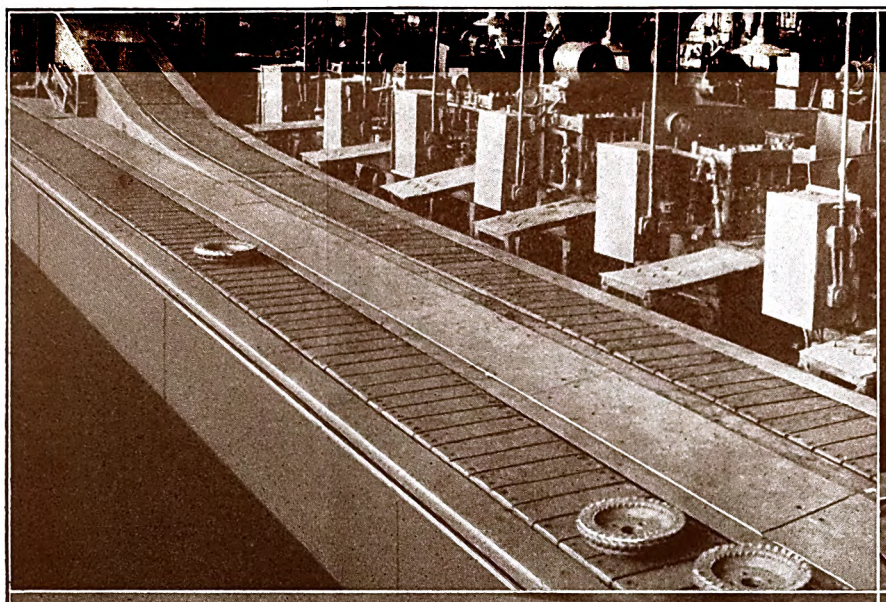
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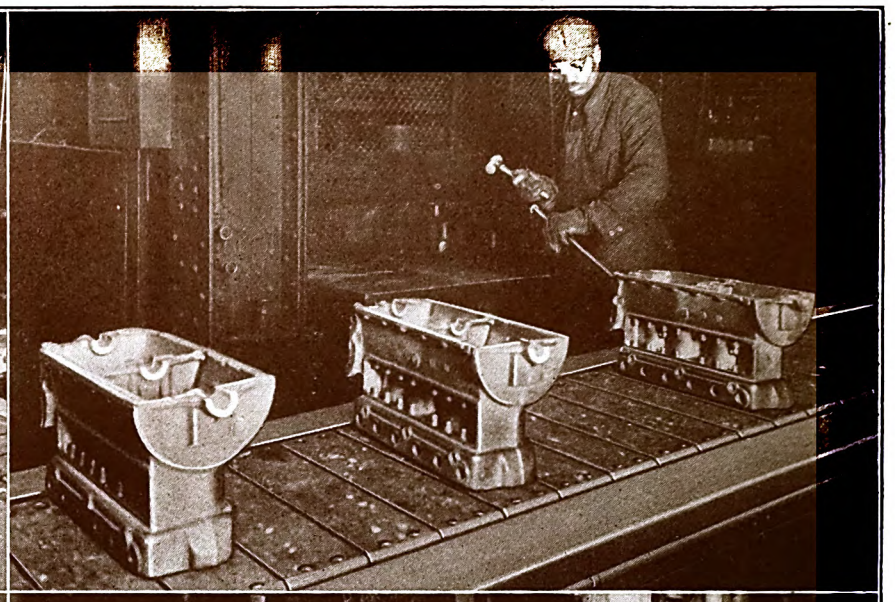
Conveyor System in the Modern Laundry.

We are always glad to supply, on request, information regarding any illustrations which appear in INDUSTRY ILLUSTRATED.

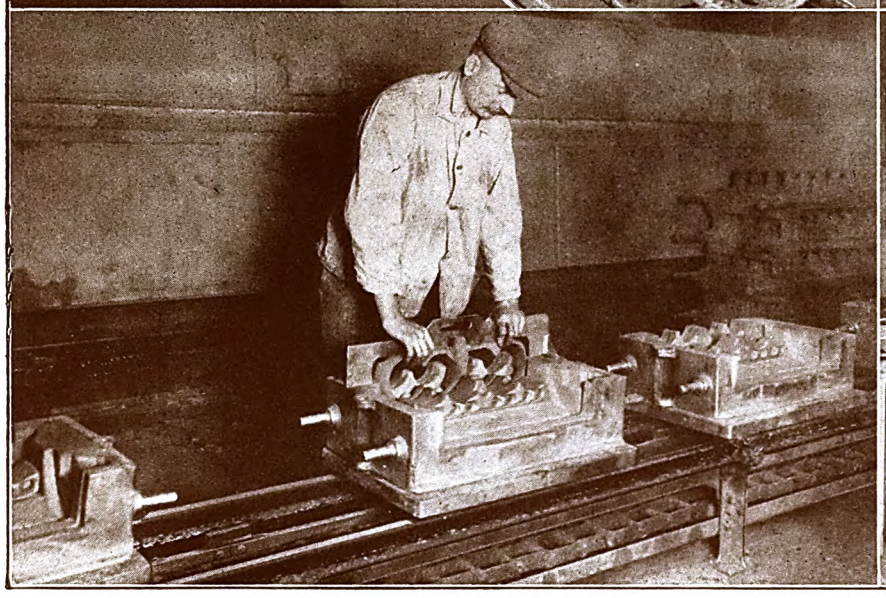
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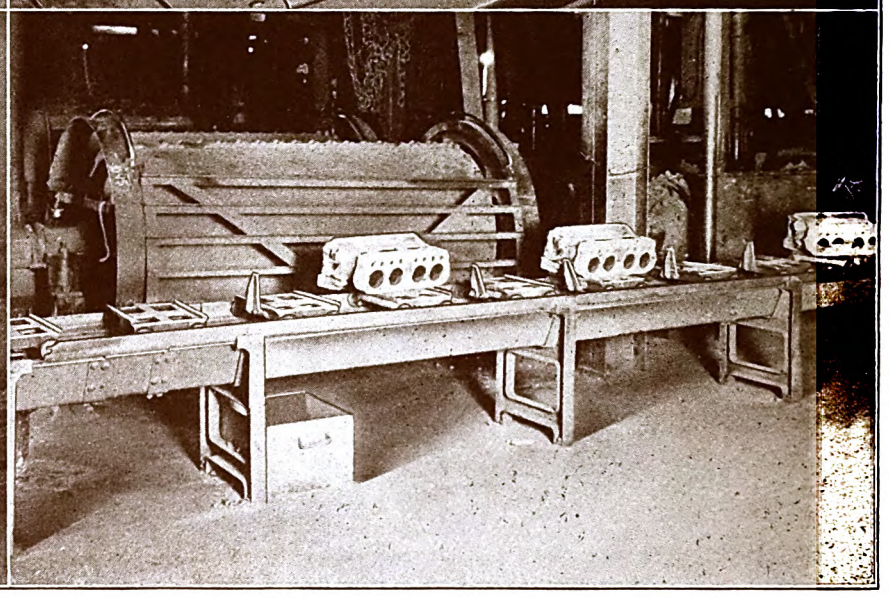
The entire output of the huge machine shop at River Rouge is transported on these two finished stock conveyors



Rough stock conveyor leading from foundry to machine shop. Chipping operations performed en route



Portion of one of the seven heavy "drag systems" on which Ford cylinder molds are constructed "on the move"



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Link-Belt Conveyors at Ford Plant

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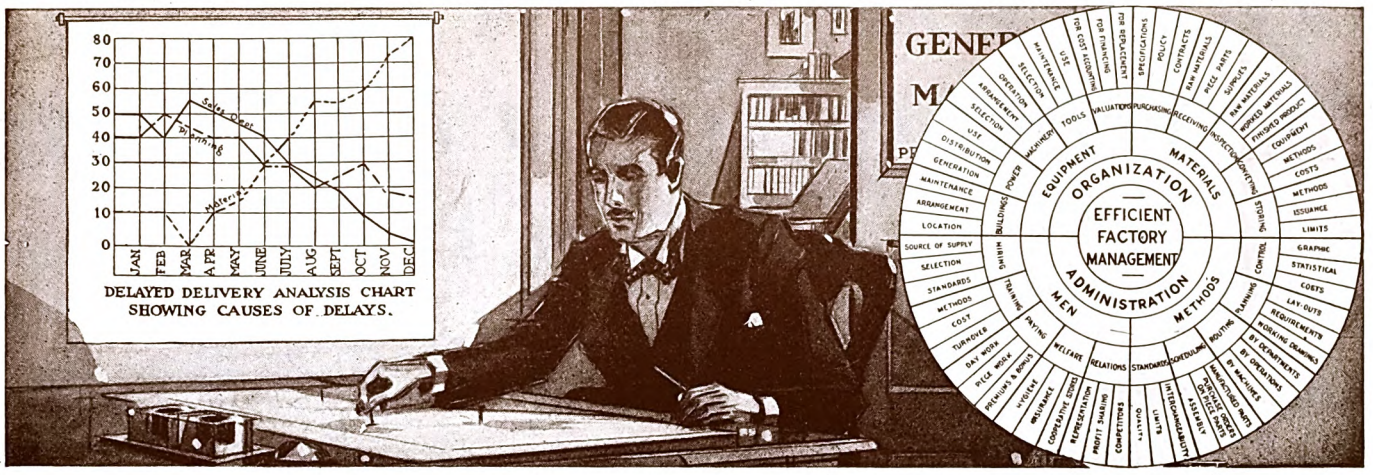
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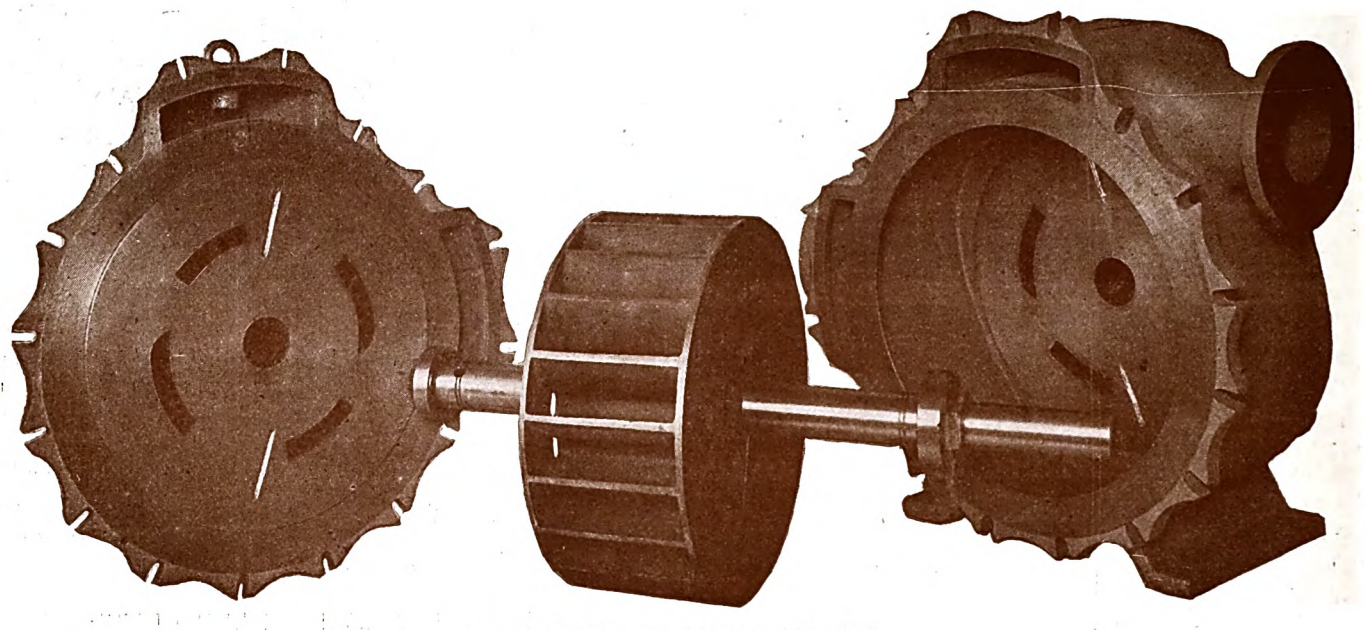
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NASH HYTOR

THE ECONOMICAL AIR COMPRESSOR AND VACUUM PUMP



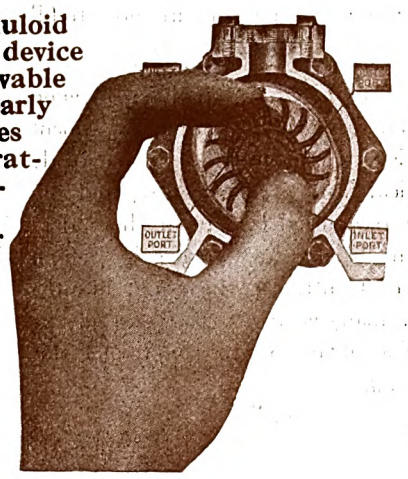
ALL THE PARTS OF THE HYTOR

THE HYTOR COMPRESSOR is valveless, has no gears, loose moving or reciprocating parts, no piston packing to renew, no cylinders to lubricate and no bearing adjustments to make.

The rotor, the only moving part, is cast in one piece, the blades being rigidly reinforced by shrouds. The rotor is mounted on a short, stiff shaft supported at each end by the highest grade annular ball bearings mounted outside of the casing.

As the peripheral clearance is large, there is no possibility of the ends of the rotor blades coming in contact with the casing.

This celluloid graphic device with movable rotor clearly illustrates the operating principle. Send for your copy.



The original high efficiency is maintained indefinitely in continuous service.

The air is thoroughly washed during compression and contains no oil.

Hytor compressors occupy very much less floor space and are much lighter in weight than reciprocating compressors They run without vibration.

The cost of installation is greatly reduced as no expensive foundations are necessary.

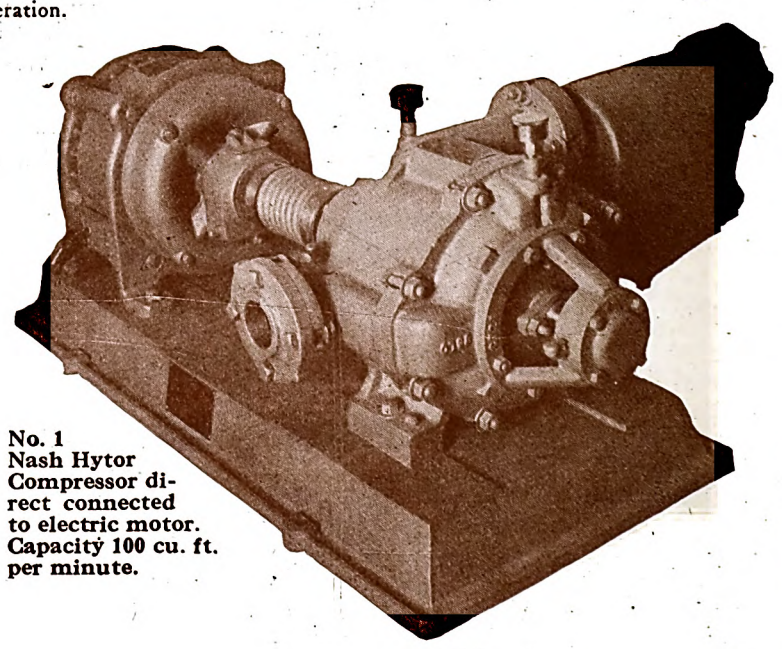
No expert attendance is required as there are no adjustments to make. The cost of upkeep is negligible.

Hytor compressors are quiet in operation.

At pressures up to and including 15 lbs. per square inch, and vacuums up to 20 inches of mercury, the Nash Hytor affords the simplest and most economical means for handling air or gas, for all of the usual purposes where air under pressure is required, and they can be used on many special services for which the ordinary compressor is not adapted.

It is common practice in handling mildly acid vapors to re-circulate thru the pump an alkaline solution for the protection of the cast iron structure of the pump. In handling chlorine gas, concentrated sulphuric acid is re-circulated.

Air handled by the Hytor is delivered absolutely clean and free from dust or oil; a great advantage in the agitation of good products or in absorption processes where diffusion of air is accomplished by blowing thru filters, porous blankets or small orifices.



No. 1 Nash Hytor Compressor direct connected to electric motor. Capacity 100 cu. ft. per minute.

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Industry Illustrated

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EDITORIAL

The March of an Idea

MEN'S reactions to ideas are what make life so complicated, and at the same time so interesting. Since the world began, there has probably been no single idea which, promulgated or translated into action, did not meet with as many different receptions as there are types of minds. Given any specific idea, the artist asks, "It is beautiful?"—the scientist, "Is it proved?"—the business man, "Is it profitable?"—and the engineer, "Is it practical?"

Two years ago INDUSTRY ILLUSTRATED was but an idea—the idea of making graphic and humanly interesting the tremendous drama of industrial progress. A drama which, of overshadowing effect upon civilization and the lives of men, has yet failed of full appreciation because it had never before been presented dramatically.

As with any idea, no matter how dynamic its apparent possibilities, no human intelligence could foresee the reception that would be accorded this new venture in industrial journalism. Enthusiasm alone cannot establish a publication; it must, first of all, fulfill a definite need.

The present issue marks the twentieth milestone in the life of this magazine. Just twenty months ago—in November, 1921—INDUSTRY ILLUSTRATED made its first appearance. Anticipating a certain amount of interest on the part of our readers, yet we confess ourselves both gratified and astonished not only by the volume, but by the quality of this response.

We believed that practical, busy men would be interested in *seeing*, rather than merely reading about the men and methods and machines that are advancing civilization by leaps and bounds—and that belief has been borne out by hundreds of letters from the very men who control and direct this progress.

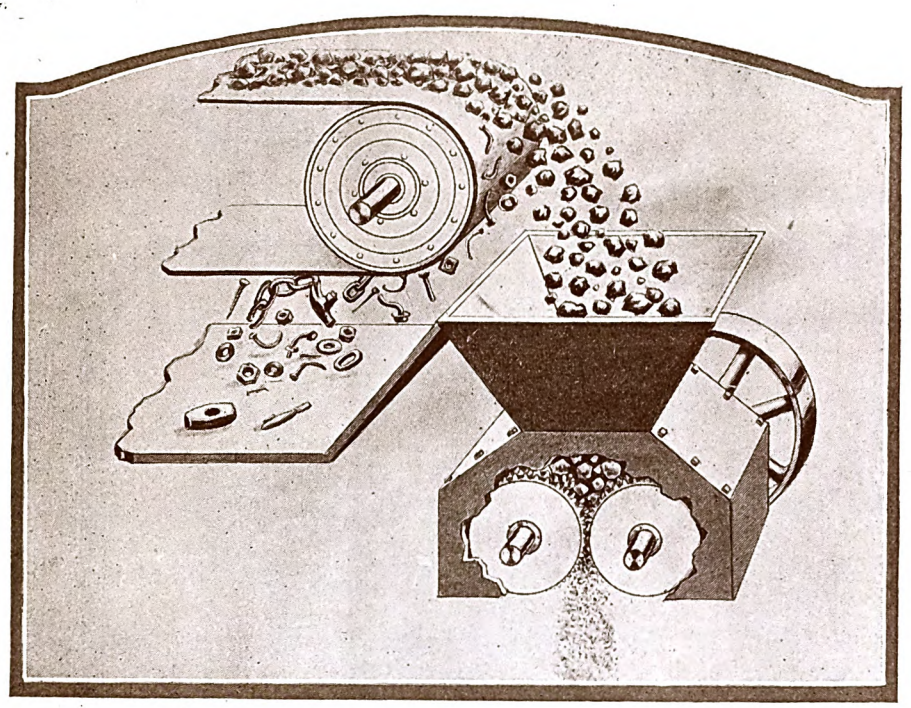
In fact, the response has been cumulative, and progressively more impressive as the months rolled on. To such an extent that we deem it only fitting to share our gratification with those who helped make it possible—our subscribers and advertisers. Beginning with less than two thousand subscribers, and carrying the endorsement of less than two-score advertisers, these twenty months have witnessed a ten-fold multiplication in the one case, and a three-fold multiplication in the other.

Without this whole-hearted cooperation, we could not in so short a time have made INDUSTRY ILLUSTRATED what it is. With this cooperation, and further stimulated by the constant evidence of live interest on the part of our readers, we can go forward with confidence, toward the goal we have set ourselves.

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Magnetism and
Their Application and Use

By R. A.



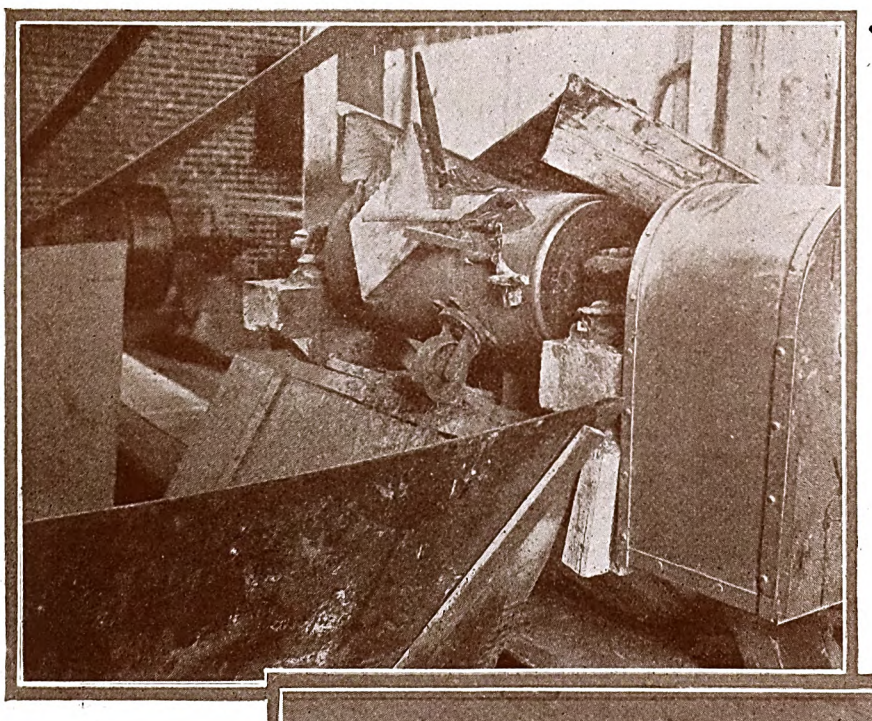
An illustration of how the magnetic pulley operates. When the material to be separated reaches the pulley, the iron and steel particles are drawn downward, away from the discharge point.

THE phenomenon of magnetism was known 3,000 years ago. The ancient Greeks discovered that the black stones in the vicinity of Magnesian in Lydia had properties different from others of like appearance, in that they attracted iron and were themselves attracted to each other by an invisible force. Many myths and legends, were told of the powers of these stones. Some thought they possessed healing qualities, others believed that diamonds could be located by them, for it was thought the stones lost their attraction in the presence of diamonds; the possibility of locating sunken treasures if large and powerful enough stones could be found was thought of, and many like hallucinations. "Magnet" derives its name from its original point of discovery—"Magnesian."

About 800 years ago it was found that by taking a piece of this black rock or lodestone and shaping it rectangular or oblong, that one end would always point toward the same direction when the piece was supported to move freely. Mariners soon recognized the value of this discovery, and the compass, of invaluable service, is the result. The divining rod, supposedly for locating mineral deposits followed next.

Magnetism and electricity are closely related but neither has revealed its identity. We use both in many ways and for many purposes, and it is the object of this discussion to dwell mainly upon the practical application of electro magnets as applied in industry.

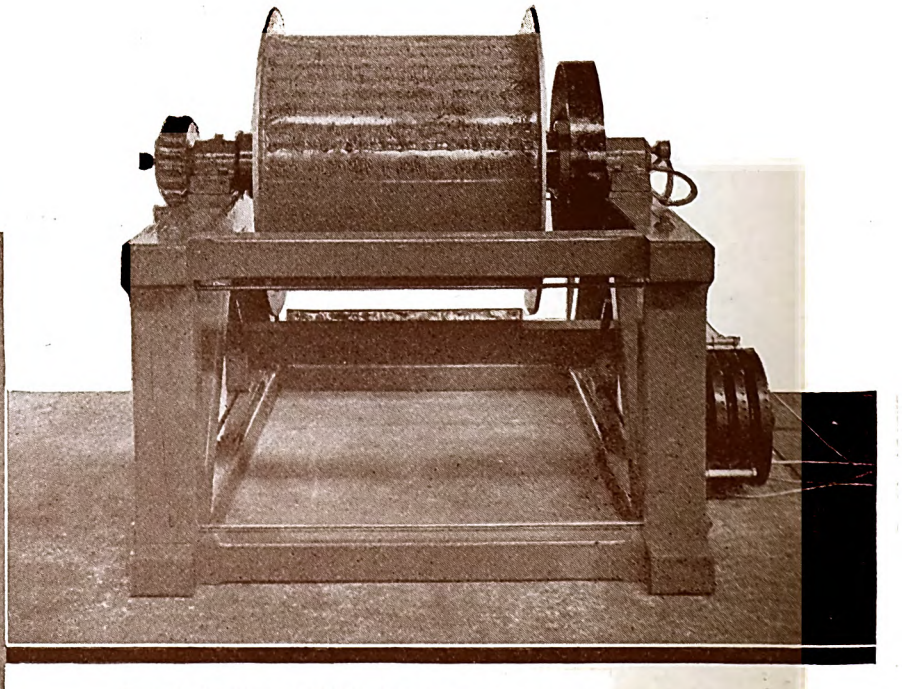
Modern science and thought explains the phenomena of magnetism by means of the molecular theory. Molecules have shape and dimension. A magnetized body is one whose molecules all arrange themselves, wholly or in part, so that all the little poles of the molecules point in one direction. The molecules assemble themselves in parallel directions with north poles pointing all one way and south poles in the other. Some substances retain the molecules in this po-



At the left is shown an actual installation of a magnetic pulley removing tramp iron, at the Canada Glue Co.



At the right—some idea may be gained from this illustration of the variety of unwanted material separated by magnetism.



A wet drum separator for crushed ore, wherein the finely crushed ore is thoroughly agitated during separation; the water preventing entanglement of particles.

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Magnetic Separators

in Industrial Development

MANEGOLD

sition while others, when this invisible force is removed, again return to their original state of rest. As a consequence, we have magnets of more or less permanent magnetic strength. The combined little molecular magnets go to make up the one large magnet.

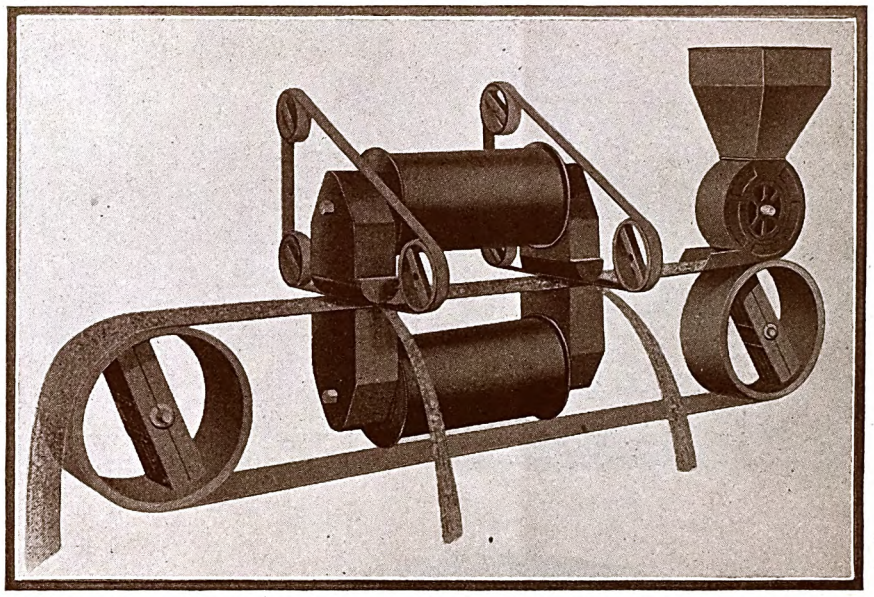
An electro magnet is a combination of a coil of wire with a core composed of iron or steel. When current is passed through the wire, it is surrounded by invisible lines of force. These lines emanate in all directions but are collected in the core because less resistance is there offered than by the surrounding air. Each molecule of the core becomes an independent little magnet with North and South Poles and combine together to make up the one large magnet.

A magnetic separator is a combination of one or more electro magnets operating in conjunction with mechanical appliances. Where magnetic material and non-magnetic material are mixed, be it coal with tramp iron; iron ore with rock; non-ferrous borings such as brass, aluminum or bronze and iron borings or ferrous borings; grains and cereals with bits of iron; potters slip and clay with specks of native iron, etc., the magnet serves to attract that portion which is susceptible, and the mechanical means serve then to deflect or carry it out of the general direction of flow.

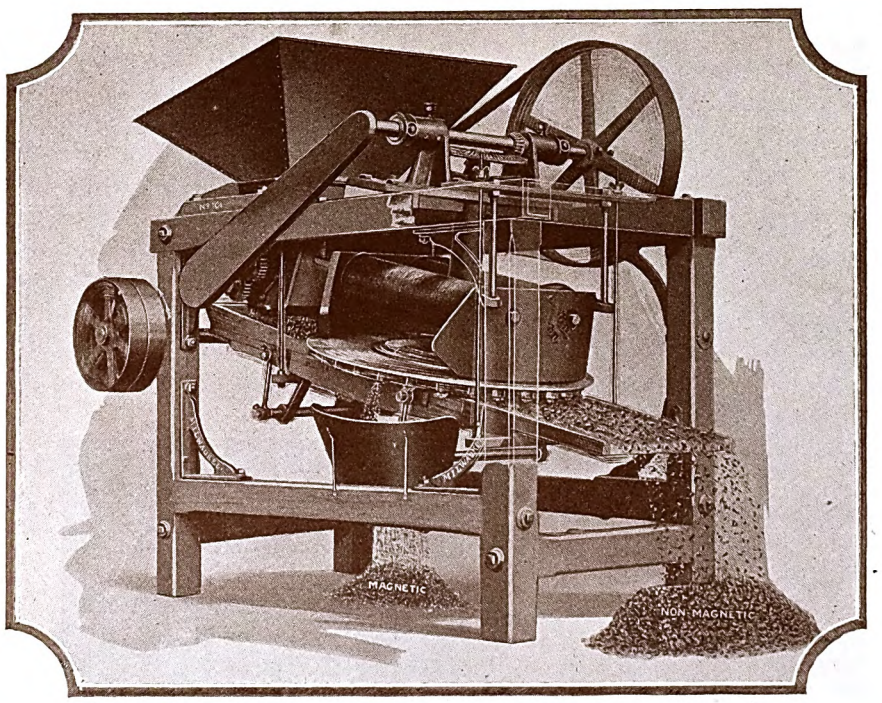
The problems encountered with magnetic separators can broadly be classified in three general groups:

1st—The removal of tramp iron before grinding or crushing.

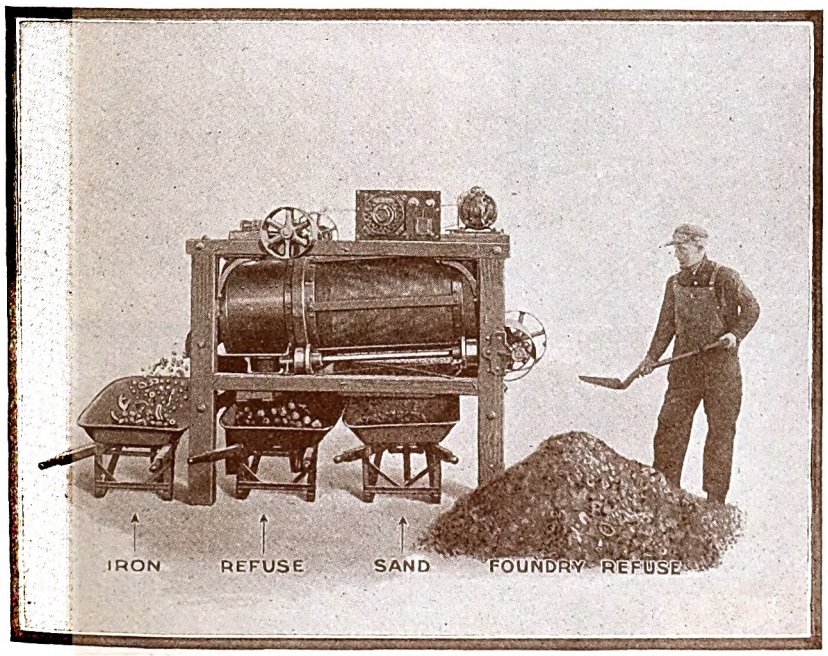
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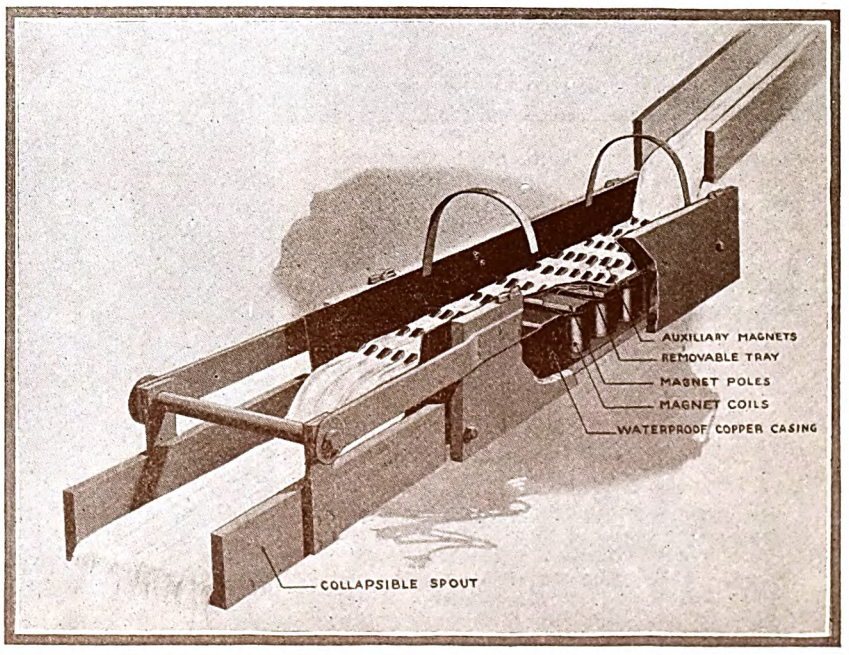
Above is an illustration of the principle of operation of a high intensity Cross Belt type separator, which removes magnetic material from a passing belt.



In machine shop practice, where bronze and brass borings to be remelted must be free from iron borings, the separator shown above is often used. The borings are fed into a hopper which insures even feed upon an inclined shaker; the magnet deflecting the iron particles as shown.



Revolving screen separator, with magnet at the lower end. This type is used in iron foundries to reclaim metal from waste, after the reclaimable sand has first been screened and salvaged.

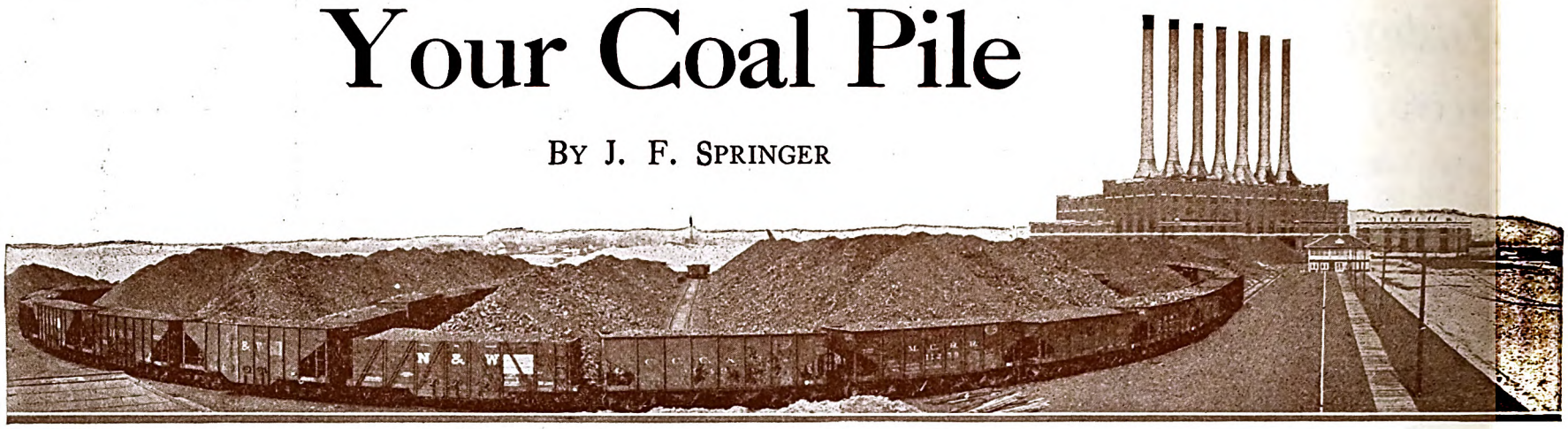


For potteries, the clay to be used must first be freed from iron particles (which cause blue specks and blisters). The clay, made liquid with water, is run through a trough equipped with a separator, as shown above.

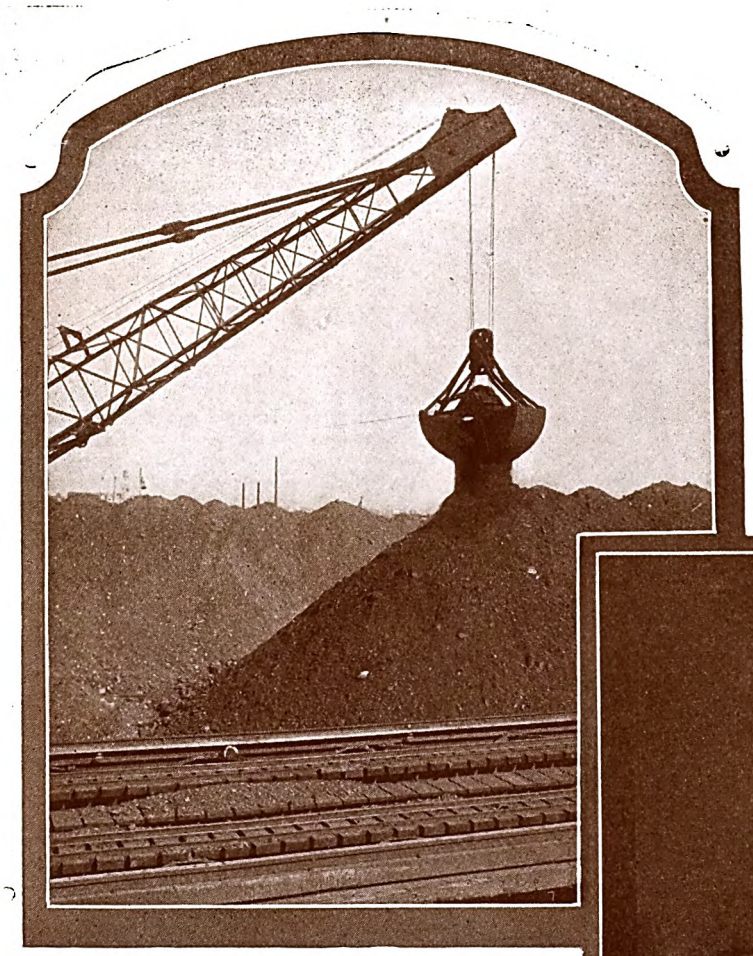
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Keeping the Fire Demon Out of Your Coal Pile

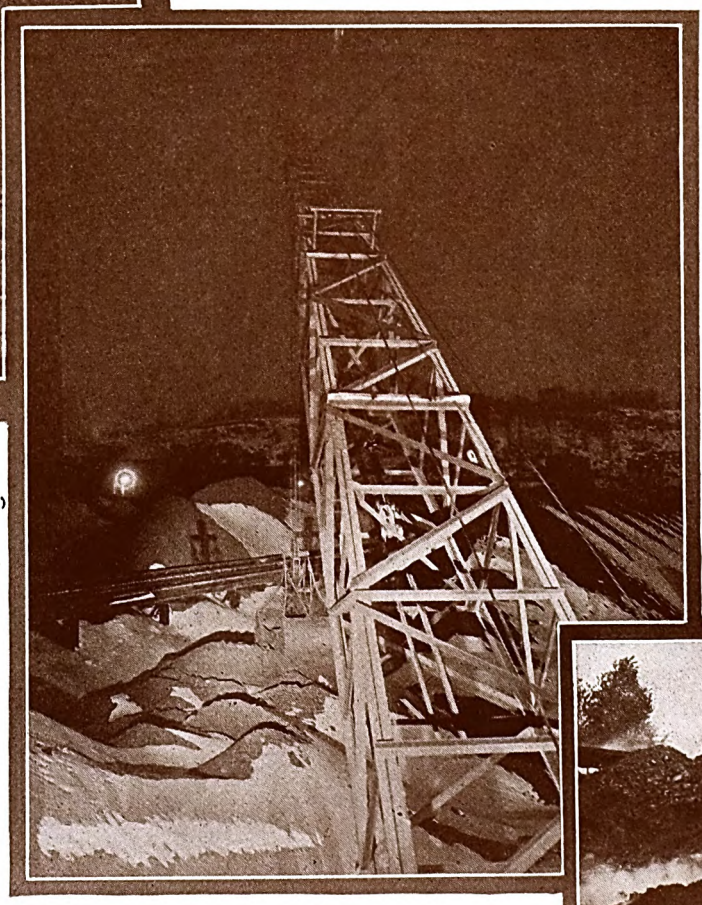
By J. F. Springer



It is in places such as this (Detroit Edison Co., as typical of central station coal storage) that spontaneous combustion must be especially guarded against.



Storing coal in a "ridge pile," which is kept within a fixed maximum height; to prevent too large a pile in one place, and to permit access to every part. One of the accepted preventive measures against spontaneous combustion, is to have no part of the stored coal more than ten feet away from the air-cooled surface.



The great one-hundred-foot boom of the locomotive crane of Shadyside, N. J., the New York Edison Company's storage yard. This was taken at night, and gives an idea of the illumination which permits constant supervision by night as well as by day.



A coal fire that has worked its way to various parts of the pile; a difficult problem to handle.

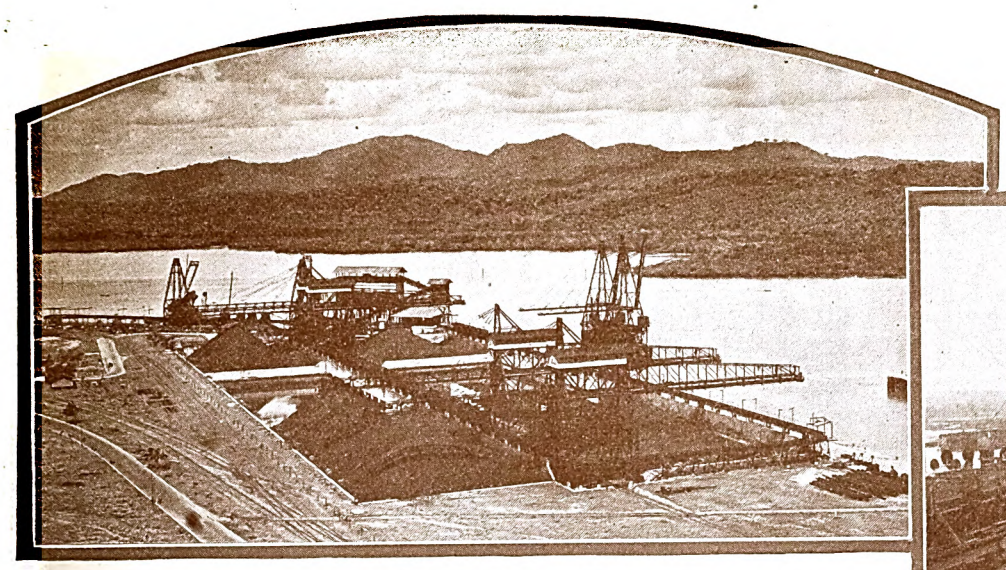
IT has not been so long since the spontaneous combustion of coal was in effect regarded by intelligent people as something to be classed with sea-serpents, fairies, and the like. The intellectual view was that self-ignition did not occur, and that stories of coal-laden ships sailing for distance ports but never arriving because the coal had fired itself were nothing but examples of loose talk. Perhaps some of the ships had gotten afire and had in consequence gone down, but some one had dropped a lighted match or thrown a lighted cigar into the coal. They refused to believe that a mass of coal could get on fire without human help.

Apparently, however, the stories persisted and became too numerous and well supported by other facts to permit unbelief to maintain itself quite so stiffly. At any rate, during recent years a change has come about in respect to the belief in the self-ignition of coal. This phenomenon is now known to be a frequently occurring one.

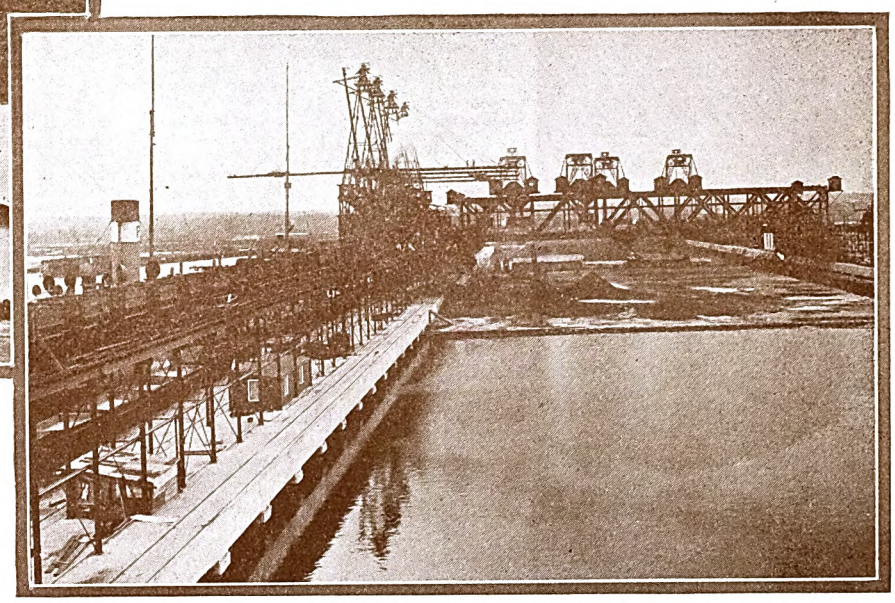
As a matter of fact, the spontaneous ignition of a coal pile is often, or ordinarily, a matter of some mystery. It is not the normal thing that the fire begins on the surface and eats its way down and around. On the contrary, a very typical way for a fire to begin is deep down in a big mass of coal. The reader may wonder how this can be. Can a fire really get started twenty feet below the top of a thirty-foot pile? And, if it does start, where will the necessary oxygen come from to keep it going? These are pertinent questions, and ones that the reader may think ought to be answered.

It is believed at the present day that air circulates in a pile of bituminous coal. That is, it

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Balboa coaling station of the Panama Canal, showing wet storage pits between the nearer and farther coal piles.

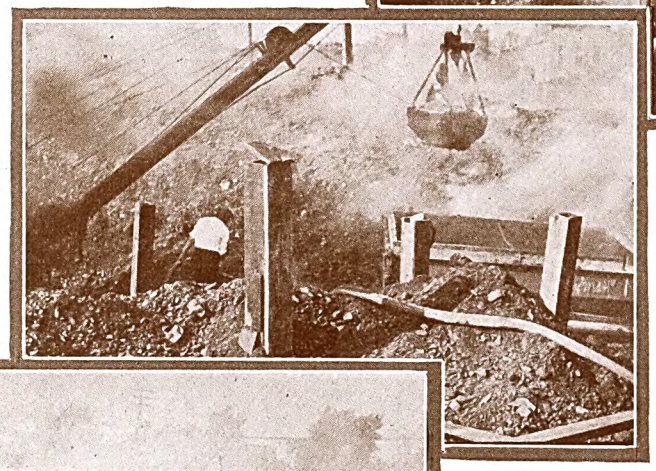


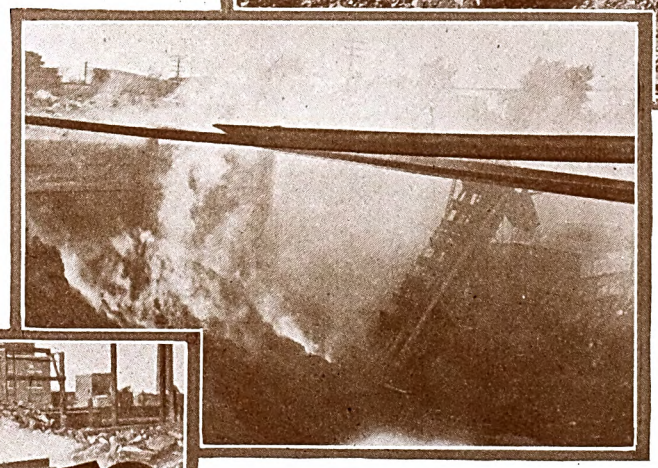
Another view of the wet storage pits for coal at Balboa, Panama Canal coaling station.

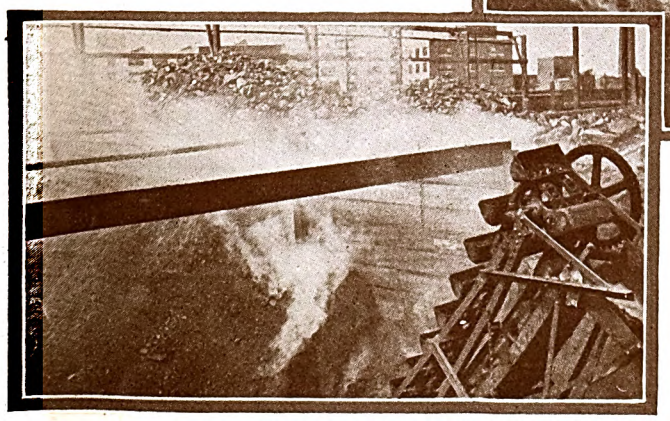
is thought that fresh, external air pours in and that old, internal air pours out. If this is indeed the case, it is conceivable that a fire once started would keep on burning—slowly perhaps, but still burning. In one particular case, it has been estimated that a complete change of air in the pile required nine and one-half hours. This would indicate a very slow movement, but it would nevertheless be a circulation bringing in new oxygen to replace the loss of old. An experiment was tried some years ago—in France, I think—in which a coal pile was provided with a cover having one or more openings which could be closed when desired. The temperature rose and fell with the opening and closing. This seems to indicate that circulation took place, and that some chemical action occurred which resulted in a rise of temperature.

It is held at the present time that bituminous coal exposed to the air undergoes a slow oxidation. This would mean absorption of oxygen from the air. Perhaps we have here enough to justify us in not being surprised at the occurrence of a circulation. Picture to yourself a little air pocket down in the coal pile, where no reductions in temperature of the external atmosphere can affect it. One-fifth of the air in the pocket is oxygen. If, now, by a chemical reaction, the coal absorbs this oxygen, the same space would be occupied by the nitrogen remaining. I am supposing, for the moment, that this little pocket is cut off from all others. The nitrogen would of course expand and fill the space, but the air pressure would be reduced, as there is present in reality only enough nitrogen to fill four-fifths of the space at the normal tension of the external atmosphere. In short, it would appear that withdrawals of oxygen result in a partial vacuum. Outside air would then enter.





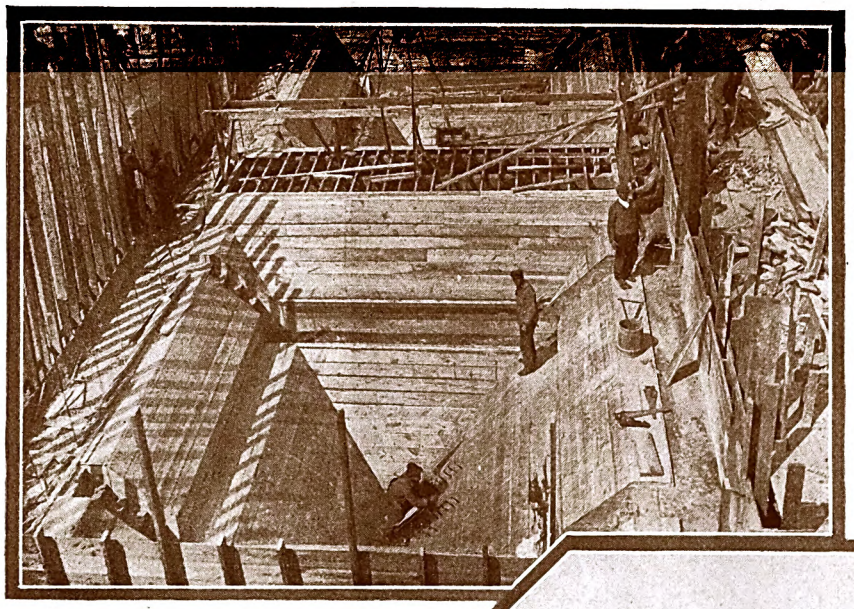




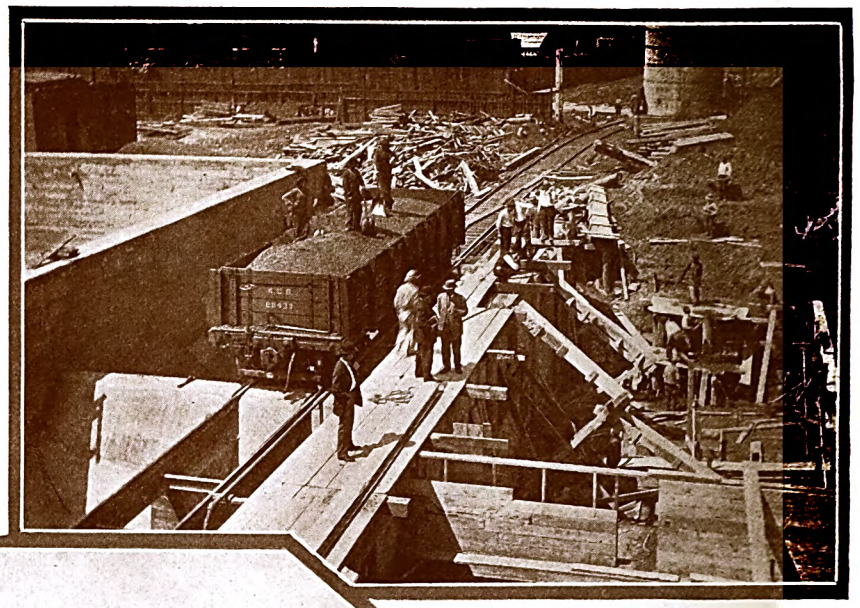
Four views of the fire demon at work. Note, in the second view, the fallacious idea of cooling the pile by means of wood vents.

Doubtless, this is only part of an explanation and does not explain the exit of the nitrogen. The nitrogen, perhaps, rises because the specific gravity is less than that of natural air. Thus, when air has the specific gravity of 1.000, nitrogen has that of 0.972. Consequently, we should expect an upward return current of nitrogen passing alongside of or through a downward current of atmospheric air. It would appear then that the circulation in a coal pile consists of innumerable small currents all seeking to flow down or up. Whether this is the right explanation or not, investigators are satisfied of the existence of some kind of circulation.

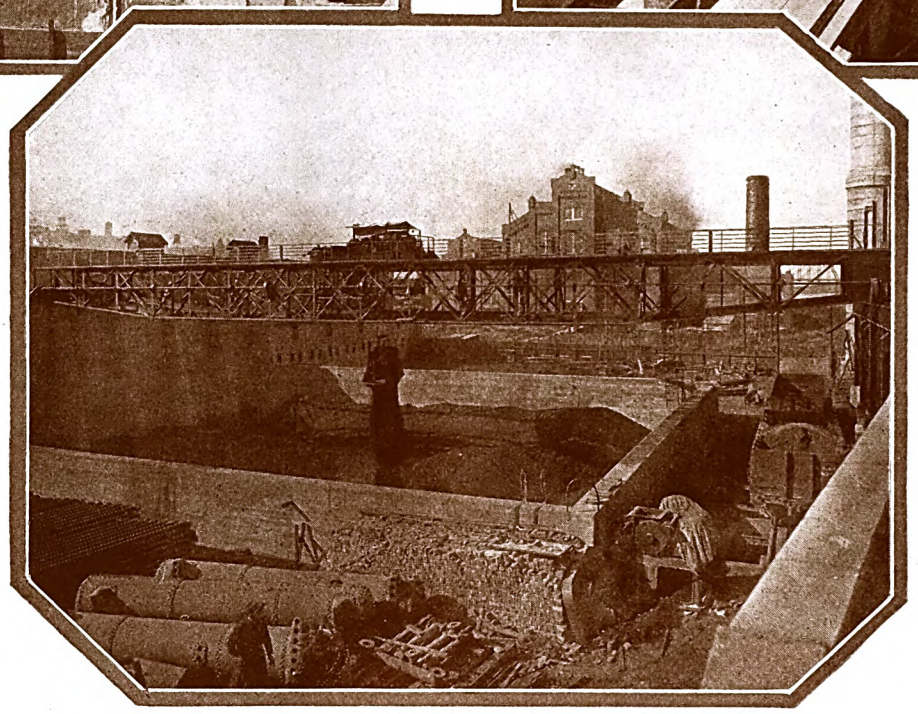
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A wet storage concrete pit at Omaha, owned by the Nebraska Power Co., Omaha, Nebraska.



Coal cars here deliver either to conveyors for immediate use, or to wet storage pit.



Below—Night view, showing illumination of coal piles at Shadyside, N. J., the New York Edison Company storage yard



Now it appears that when coal absorbs oxygen, the temperature rises. This is in fact what usually occurs when oxygen unites with another substance. In short, in the coal pile we have a slow combustion going on and this produces a small but real amount of heat. It appears also that when the temperature is higher, the oxidation becomes more active. A little reflection will now be sufficient, perhaps, to convince the reader that with the temperature being continually added to and the oxidation going on faster and faster, a time might come when the ignition point would be reached and the coal would begin to burn in the ordinary sense.

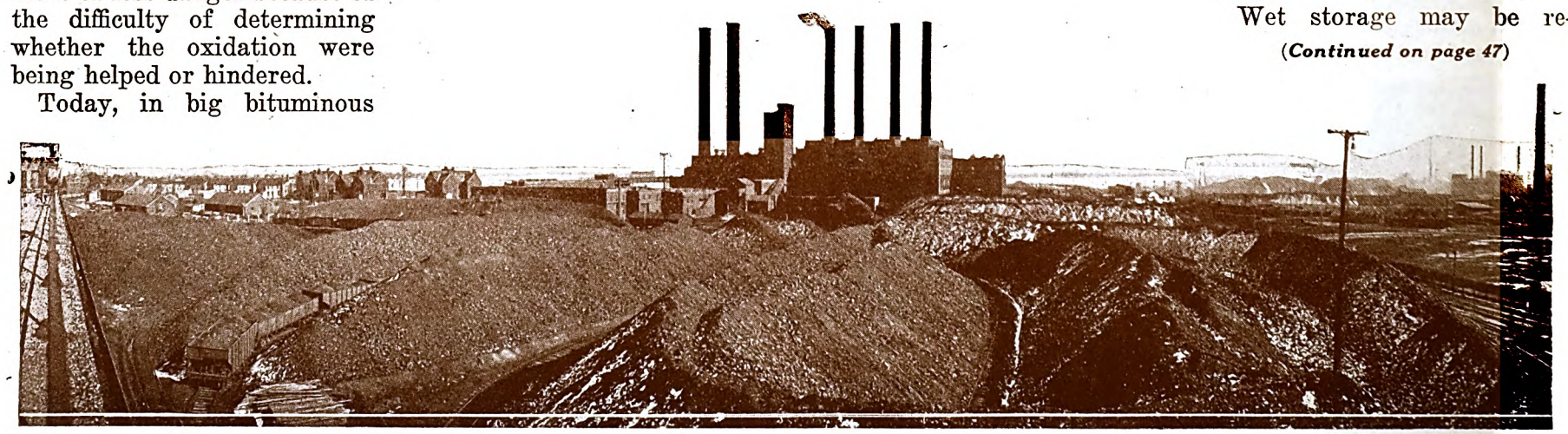
Apparently, it is possible to circulate air artificially through a pile in such quantity as to keep the temperature down and prevent ignition. This would then be a case where the cooling effect overcomes the progressive oxidation activity. As a matter of fact, the artificial circulation of air as a means of forestalling spontaneous ignition would seem to be fraught with more or less danger because of the difficulty of determining whether the oxidation were being helped or hindered.

Today, in big bituminous coal yards, spontaneous ignition is no fairy tale, but a grim reality. The Canadian Pacific Railway had great difficulty in controlling the menace and the actual occurrence of the self-ignition of the great storage piles at Montreal. This was some years ago. The coal came from Nova Scotia and was piled in Montreal in the warm season. No trouble seems to have occurred in the storage at the mines preparatory to shipment by boat when the St. Lawrence was open for navigation.

It may be considered certain that spontaneous ignition can be prevented (1) by shutting off all circulation of air through the pile, or (2) by keeping the temperature throughout the pile at a low level. This is one simple method of storing coal which accomplishes both things at once. That is, if the coal be submerged under water, no spontaneous combustion can get started. Oxidation will either not take place at all or be negligible in amount; and evidently the temperature will be kept far below any ignition level.

Wet storage may be re-

(*Continued on page 47*)



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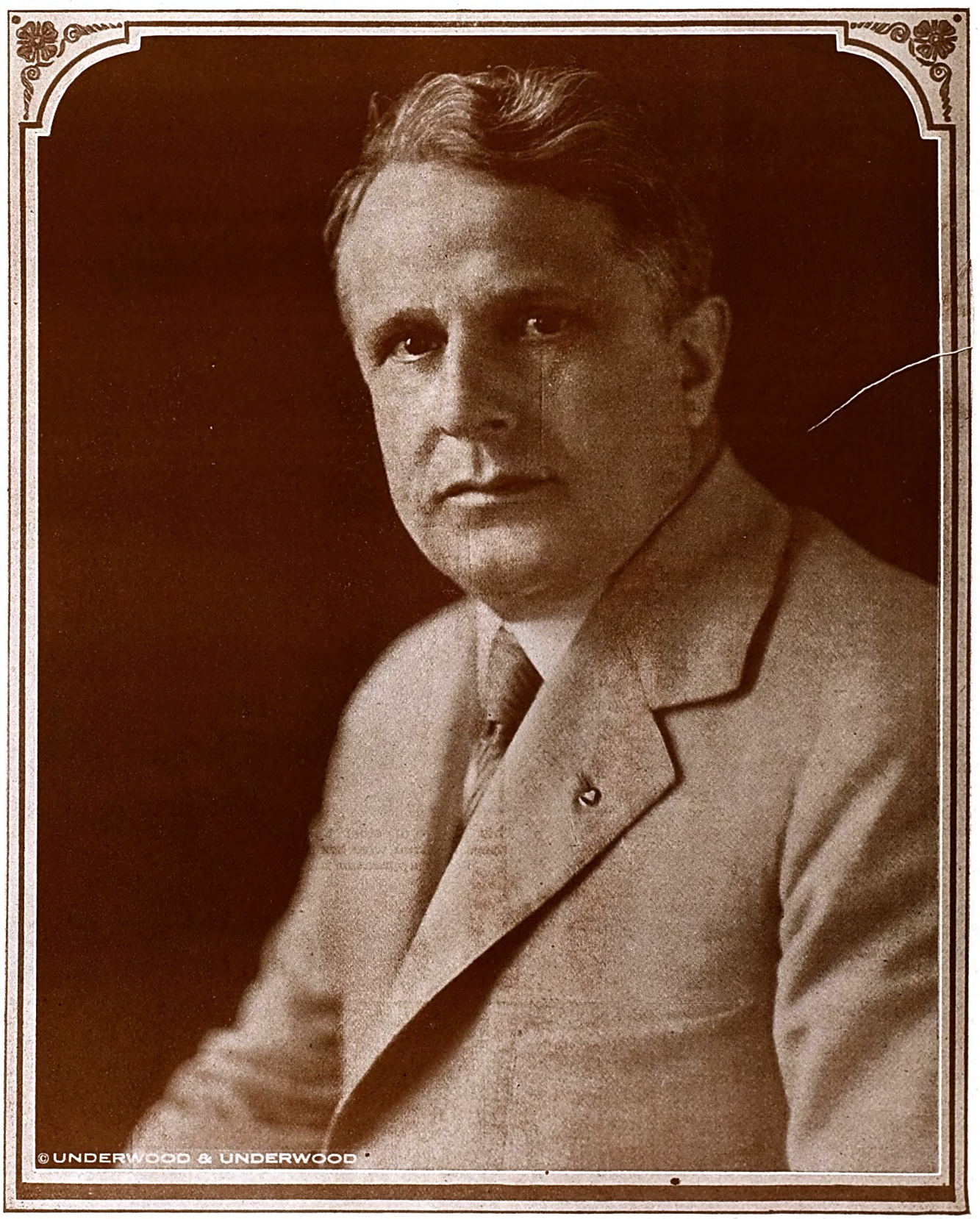
Do We Need More Foreign Labor?

Secretary of Labor James J. Davis, on Immigration

IN view of the increasing shortage of common labor, and the agitation for a repeal of the present restrictions on immigration, many of us lose sight of the really important problem—the problem of America as a Melting Pot. It is this fundamental problem that our Secretary of Labor has in mind when he says:*

"I propose that we establish strict, but just tests of physical and mental health, and that we make those tests under the numerical restriction now placed by law on immigration. I would have those tests made abroad in order that the applicant for admission may not have to spend the savings of a lifetime on a long sea voyage, in order to find out whether he can enter the United States. The Solicitor of the Department is now inquiring into the possibility of moving our whole examining machinery to foreign countries under our present laws. I feel that nothing would so strengthen our whole immigration policy.

"It is a short sighted policy to seek cheap labor through immigration. Today, because of the demand for workers, there is a perceptible movement of common labor of a low grade from a contiguous country. Large groups of this nationality are finding their way into our mills and factories. I have talked with employers who have taken on these men, and in every case they admit that an upstanding American workman would do two and one-half times the work that is accomplished by the individual of this racial group. That being so, it is quite apparent that it is cheaper to pay an American worker twice the wages which the foreigners receive. It has been my experience since the days when I worked in the mills that cheap labor is expensive labor, both for the industry which employs it, and for the community which houses it."



The Honorable James John Davis, Secretary of Labor, was born in Tredegar, South Wales, in 1873. Coming to the United States with his parents in 1881, he began as a puddler's assistant in the iron works at Pittsburgh, at the age of eleven, and was a puddler at sixteen. Moving to Elwood, Indiana, at the age of twenty, Mr. Davis worked in steel and tin plate mills there. He became City Clerk, and later, Recorder of Madison County; director-general of the Loyal Order of Moose; president of the American Bond and Mortgage Company of Pittsburgh; Secretary of Labor in President Harding's Cabinet————to mention but the highlights of a splendid and typically American career.

* Our Labor Shortage, and Immigration—INDUSTRIAL MANAGEMENT, June, 1923.

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Painting the Factory

How and When to Paint—and Why

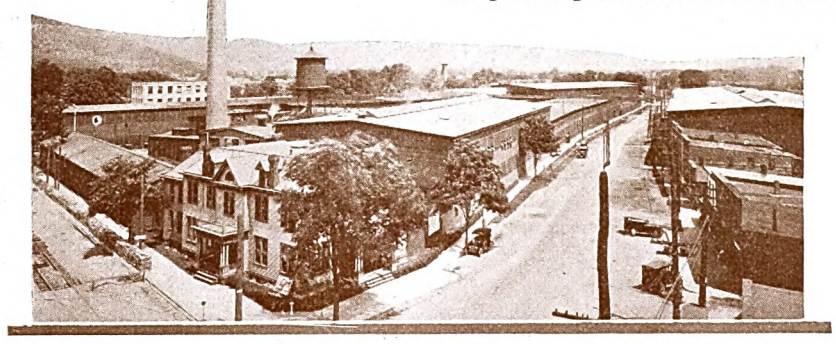
BY REGINALD GORDON

THE appearance and permanence of factory buildings depend largely upon paint. A group of buildings that present a new, clean aspect give a certain tone to a plant whether large or small; and the impression that a stranger receives on approaching such a place may have considerable influence on his attitude in entering upon negotiations with the management. Even the effect of a neat, well painted building upon the casual traveler passing the plant should not be overlooked. Wooden buildings require frequent repainting; galvanized iron roofs and sidings must be kept painted to resist corrosion; brick and concrete walls, even when not painted, are set off to better advantage by regular paint maintenance of the doors, sash, cornices, etc.

Paint is a preservative, and for this reason progressive executives are careful to keep their buildings and other plant structures well painted. Since the labor cost is the largest item in the total expense of a painting job, certain factors must be taken into consideration when an outlay of money for this purpose is to be made. These are: (a) the minimum number of gallons of paint required to do the job properly; (b) the minimum cost; (c) the minimum man hours of labor (d) the durability or life of the paint after it has been applied; and (e) the appearance of the finished work.



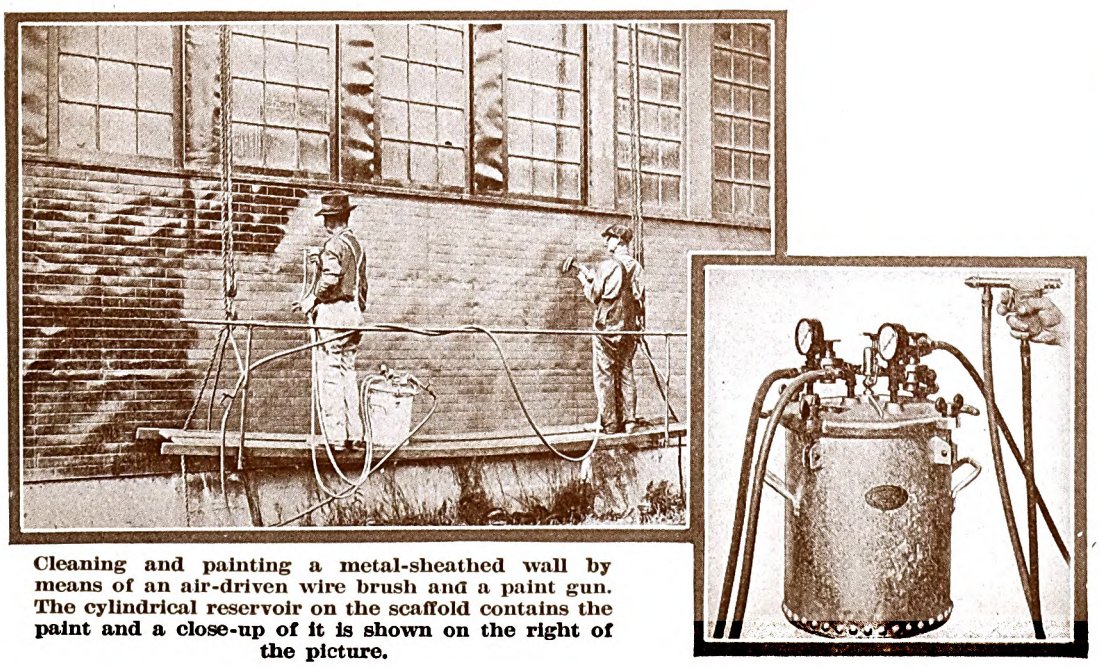
The painter shown here is applying a coat of paint especially adapted to protection of steel work.



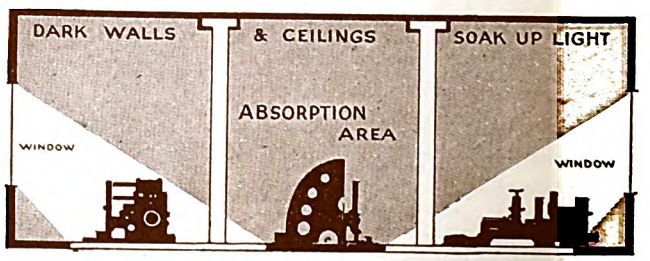
This group of steel buildings was cleaned off with air-driven wire brushes and painted with air brush apparatus in 100 working days.

Money spent for painting is an insurance premium and a necessary outlay against deterioration. Deterioration is an inevitable even if slow process of destruction, for it is slow, very slow combustion. Everything exposed to the air oxidizes more or less; therefore in preventing this process by painting our buildings we are buying insurance against sure but slow burning, exactly as we buy fire insurance against rapid burning which perhaps may never occur. We almost never take a chance on the occurrence of an actual fire; but often we let buildings burn slowly by allowing them to decay, rust, weaken and deteriorate by failing to keep them painted.

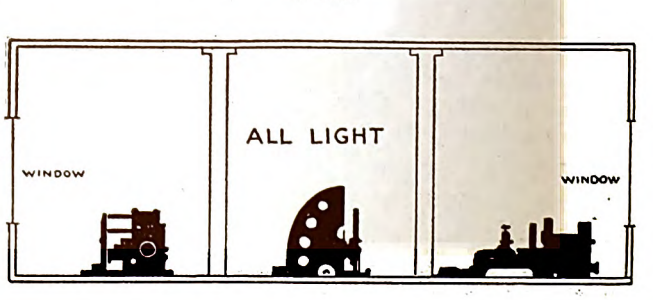
For outside work, the choice of a paint material depends upon the climate of the particular location, exposure to salt-laden air, acid fumes, smoke, etc. But wherever used, a paint for exteriors must so cover the surface, and to a certain extent penetrate it as to prevent access of air, which means access of oxygen and moisture. Wood softens and decays, steel corrodes, brick, stone and concrete absorb moisture. So there is always some part of the plant buildings that calls for the pro-



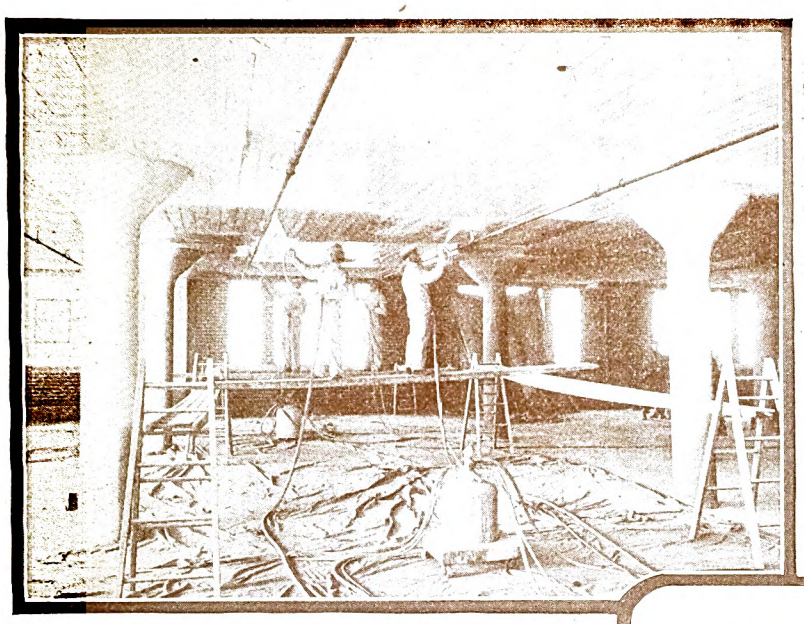
Cleaning and painting a metal-sheathed wall by means of an air-driven wire brush and a paint gun. The cylindrical reservoir on the scaffold contains the paint and a close-up of it is shown on the right of the picture.



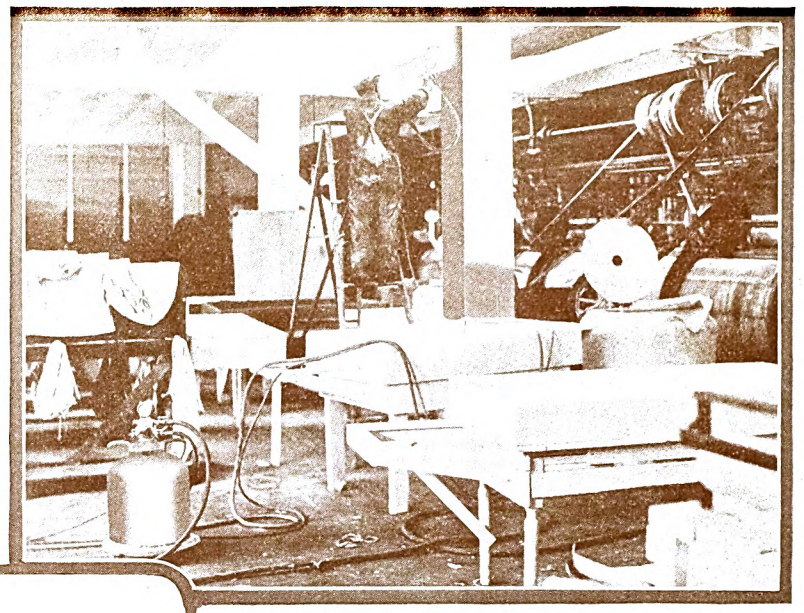
These two diagrams illustrate the possibilities of improving the illumination of a machine shop by painting walls and ceilings white.



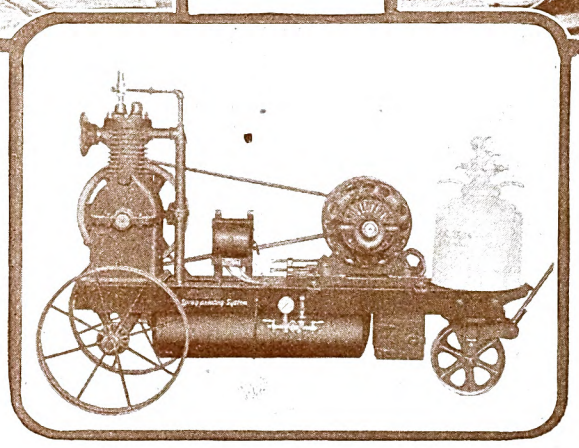
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Portable equipment for spray painting. Note that one set can be used for two or more painters.



Note how easily the spray nozzle enables the painter to work around corners and inaccessible places.



This equipment can be pulled about to any part of the plant, wherever a supply of electricity for the motor is available.

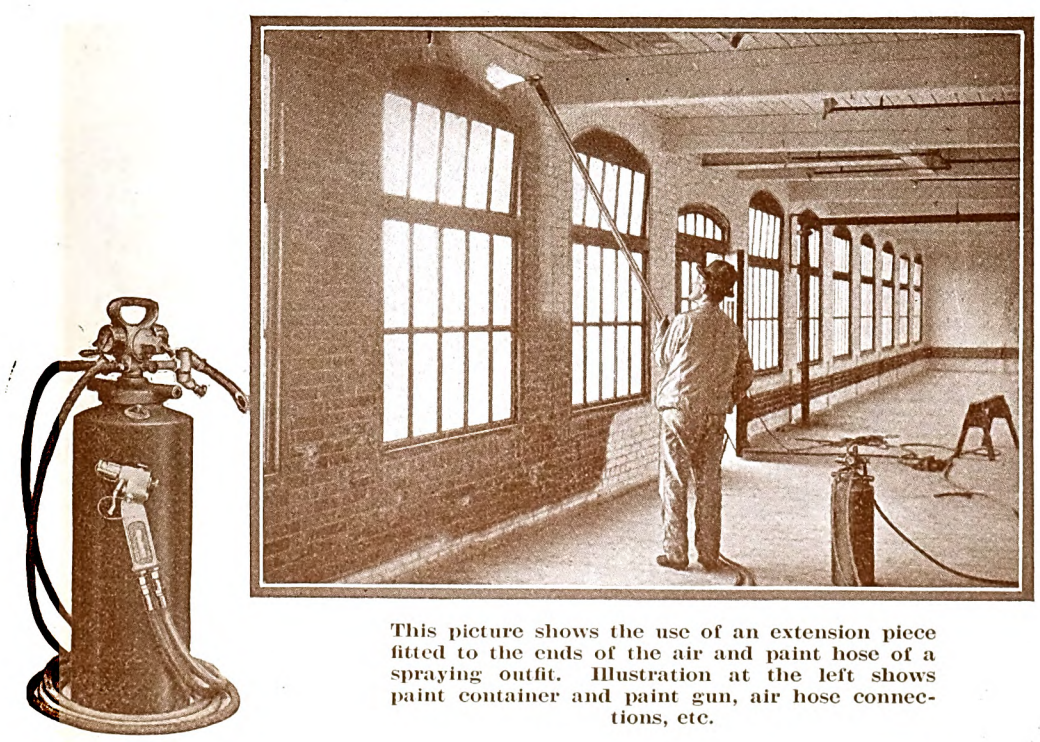
tection afforded by paint. Saving money by neglecting to paint factory buildings results in giving a poor impression of the company to employees as well as to strangers; and what is equally bad, unpainted buildings deteriorate rapidly.

Paint in general is made up of two chief constituents: a base, commonly white lead, and a vehicle which mixes with and carries this material. A volatile constituent, usually turpentine, is also added for the purpose of making the paint flow more easily when brushed on. The vehicle in commonest use and that which experience has shown to be most satisfactory is linseed oil. Coloring matter or pigment added to a paint gives it the desired hue or color, but does not constitute its permanent basis. After paint is applied, the drying of the oil, when the mixing has been properly done forms a tough, slightly elastic coating on the surface, holding the pigment and coloring matter in place.

For the best results, it is generally agreed that the most useful and durable bases for paint are white lead (lead carbonate) and zinc oxide. For certain purposes, however, especially on steel work, red lead and iron oxide are found to be best adapted. In addition to white lead and white zinc there are substances on the market sometimes used as substitutes for these and often mixed with them to a greater or less degree. These are called "extenders" or "spreaders." Many expert paint men maintain, however, that they add neither durabil-



These two pieces of timber were cut from the sill of an ice house built in 1893. Five years is the usual life of such timbers, but the end shown in the lower illustration has been painted with a preservative preparation, which accounts for its excellent condition.

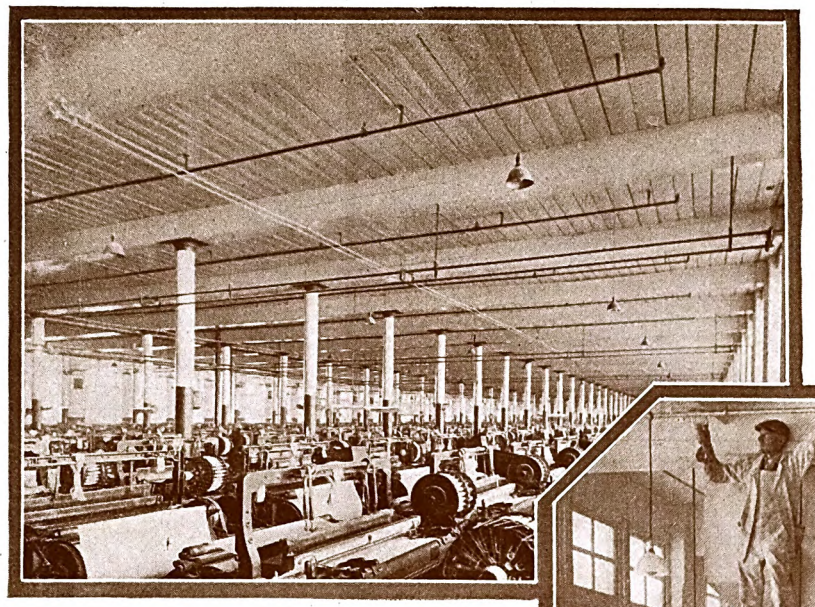


This picture shows the use of an extension piece fitted to the ends of the air and paint hose of a spraying outfit. Illustration at the left shows paint container and paint gun, air hose connections, etc.



Another example of the convenience of compressed air painting equipment, where a 6-foot extension pipe enables the workman to reach any portion of the ceiling.

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Notice the bright, uniform illumination furnished by the white painted ceiling and walls in this weave room.



These cooking kettles and the hoods over them, as well as the radiators are brightened up with aluminum bronze paint.



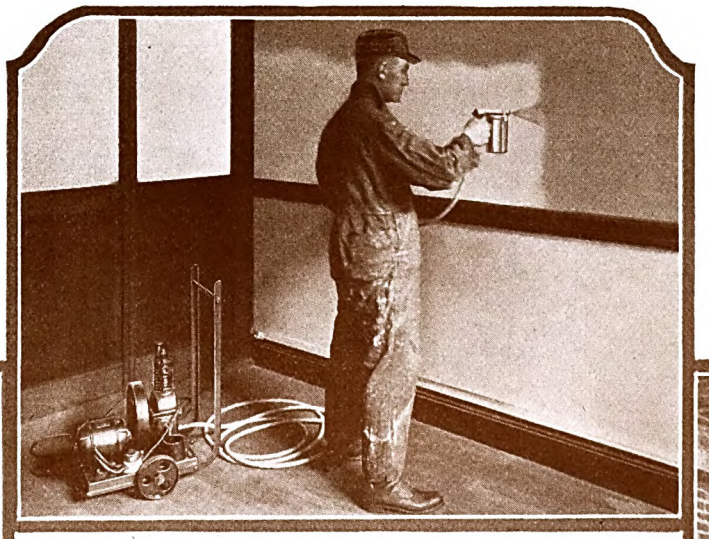
Covering machinery to protect it when ceilings are painted. Machinery need not be covered, when spray painting is employed

ity nor appearance to a job, because when mixed with the oil they weaken a color and tend to give it a grayish appearance. Most of these extenders are white, yet when mixed with linseed oil they look gray. Many low priced paints contain what is called "turpentine substitute," a volatile liquid that for many small jobs gives satisfactory results, and there are some substitutes for linseed oil; although these are not considered to be the most durable.

Whether out or indoors, all surfaces to be painted must first be cleaned in order to give a fresh, uniform area over which paint can be spread and on which it can secure a hold. Wood and plaster must also, especially if new, have a priming or filler coat that can, as the name implies, fill the pores of the wall or ceiling and on this the color or body coat is painted. From old walls, all dust, soot, oil and grease must be removed, otherwise the finished work will show spots and streaks. Structural steel work, metal roofing, etc., is usually primed with a coat of red lead or iron oxide, as these form a close bond with the steel surface and prevent its injury by corrosion.

More careful attention is now given to the proper paint-

(*Continued on page 75*)

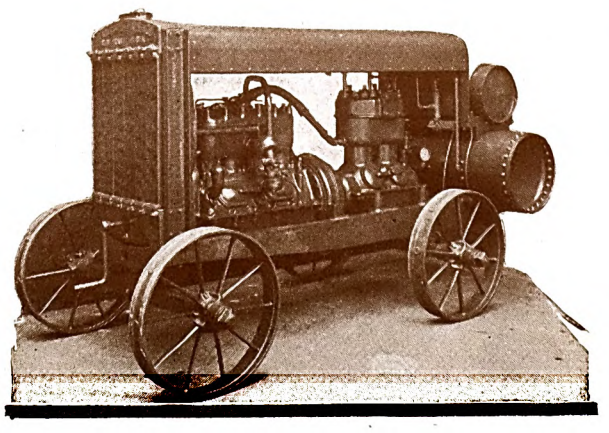


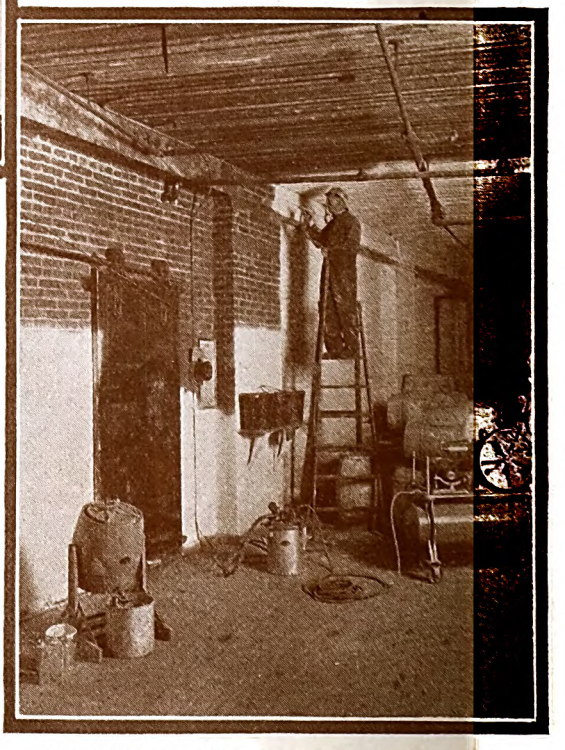
A useful portable painting set. The motor that drives the compressor can be plugged in at any electric outlet.

Below is a large portable set driven by gasoline engine, capable of supplying air to several paint sprays or cleaners equipped with wire brushes.



Painting overhead steel work without the necessity of drip cloths to protect parts stored below.





Another portable spraying outfit with motor-driven compressor.

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Making Real Vacations Possible

Companies that Provide, Not Only the Time, but the Place

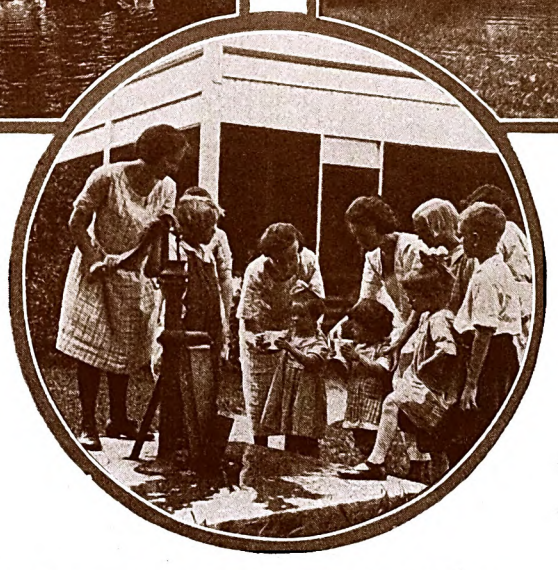
By George W. Gray



The swimming pool at Camp Sherwood, camp of the New York Telephone Company.



The Lake and the main buildings at Camp Isida, of R. H. Macy & Company.



Mothers are allowed to bring their children to the Swift & Company vacation camp at Fish Lake.

ONE hot day in August a motorist turned his car out of a smooth highway in northern Indiana to follow a less civilized but more enticing trail into the woods. Finally he came out of the forest on the shore of a lake. A soft breeze ruffled the waters and stirred the greenery of the trees—though back on the road there was only quivering heat. The motorist camped there that day and night, enjoyed some first-rate fishing, found the lake ideal for swimming, and got back to Chicago a few days later an enthusiast for his vacation find in the midst of the lonely woods.

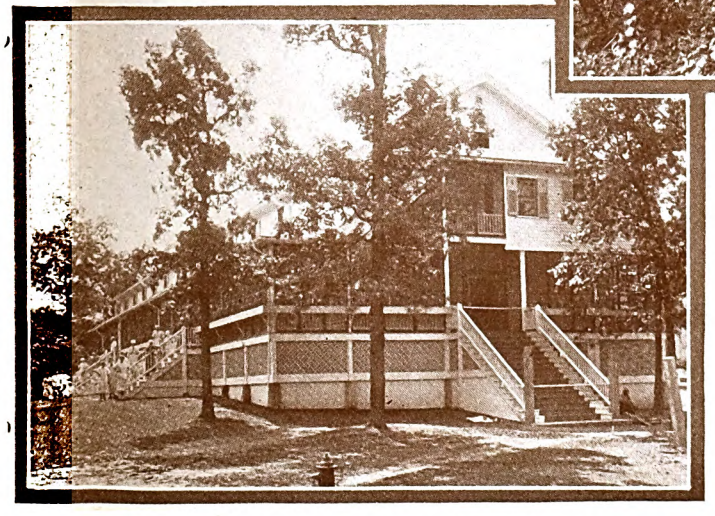
Today that hidden lake is the center of a camp developed and maintained by a great industrial company. Shacks have been built, eating quarters provided, other vacation facilities installed, and hundreds of employees go there every summer. It all dates back to that August day and that exploring motorist who, as it happened, was a large employer of labor and had been troubled with the problem of getting his people really to use their vacations for vacation purposes. Many had been spending the time loafing around their city flats, attending movies, and, as happened in some cases, actually working at extra jobs. Since he established the camp, this problem has largely disappeared.

Company vacation camps are still something of a curiosity, however, and the concerns that have established them are few. For the most part, this development in personnel work has been among employers of women. Men seem able to look

(*Continued on page 38*)



The Mess Hall at May-ga-lan-ka, R. H. Macy & Company's camp for men employees, near Bear Mountain, N. Y.



The Armour vacationists live in this white domicile, set among the oaks facing the lake.



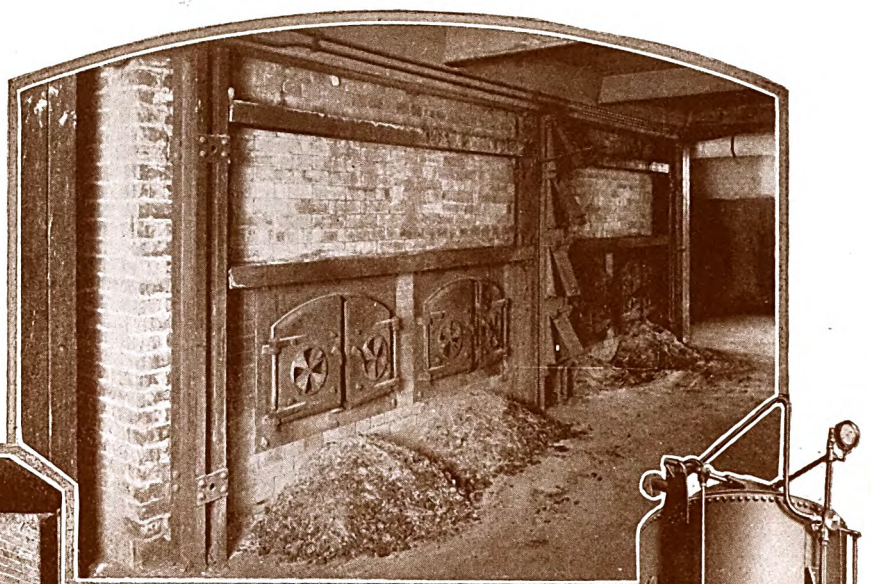
The sandy beach at Armour & Company's Round Lake, near Chicago.

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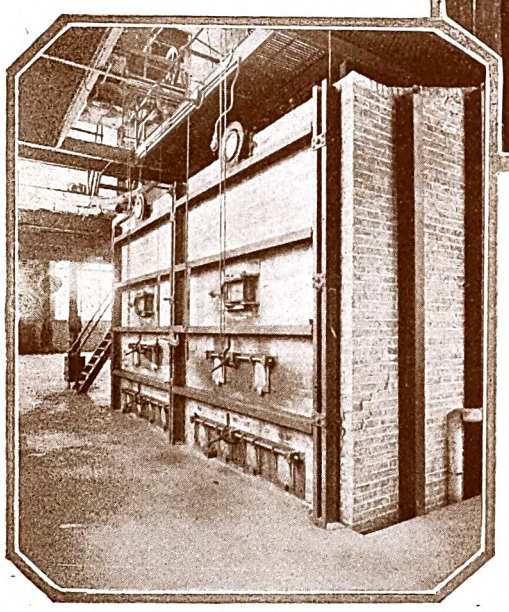
The Latest Answer to High Fuel Costs

The Present Status and Future Possibilities of Pulverized Coal Burning

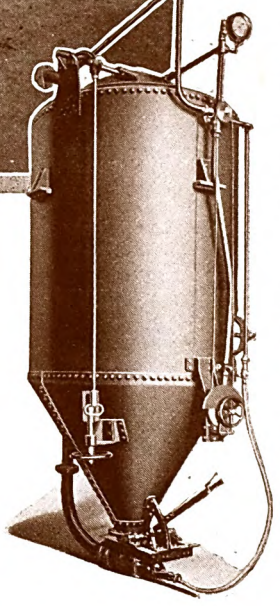
By James T. Beard, 2nd



Important savings in labor and fuel have been possible in power plants by the installation of pulverized coal-burning equipment, such as shown below. Increased convenience and cleanliness, easy regulation of the fires, improved working conditions and the minimizing of waste are some of the advantages which are evident throughout such a plant.

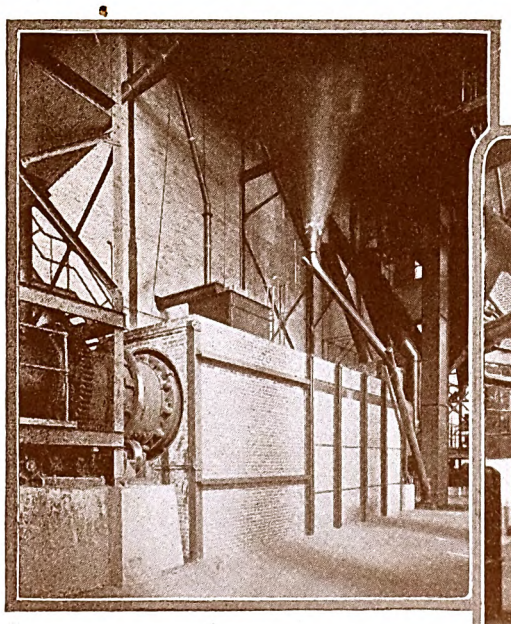


Unretouched photograph showing the kind of ash powder which is raked through the cleanout doors of a pulverized fuel-burning furnace. These fine cinders contain no clinkers, and slagless operation is secured in the use of a burner which allows a long moderate flame, permitting the ash particles to cool below their meeting point before reaching the ash pit.

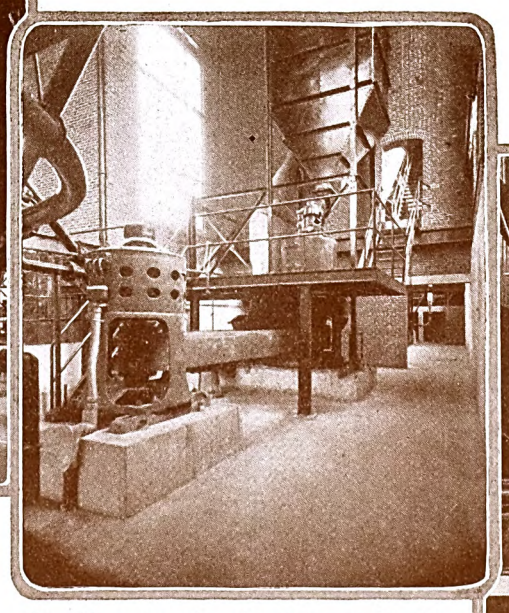


The Compressed-Air Transport System consists usually of a gate, a compressed air tank with dust-tight powdered coal storage tank, a main feed line and branches. This illustration shows a blowing tank which operates under 10 to 40 pounds for blowing and has a capacity of 1,000 to 2,000 pounds of coal a minute.

SINCE the outbreak of the World War the problem of the generation and use of power in industrial plants throughout the country has assumed a position of importance, which has never fallen to its lot before, due largely to the unusual demands placed upon the power department by the needs of increased production, the increasing cost of coal and other fuel, the high wages and unreliable character of the labor available, and many other operating factors. So long as the abnormal demand for production continued, actual costs were necessarily relegated to a place of secondary importance, provided power was available when needed. With a return to normal production, however, costs again begin to demand the attention of plant executives and every effort is made to maintain them at a proper minimum by the elimination of unnecessary waste and by the adoption of more economical equipment and methods.

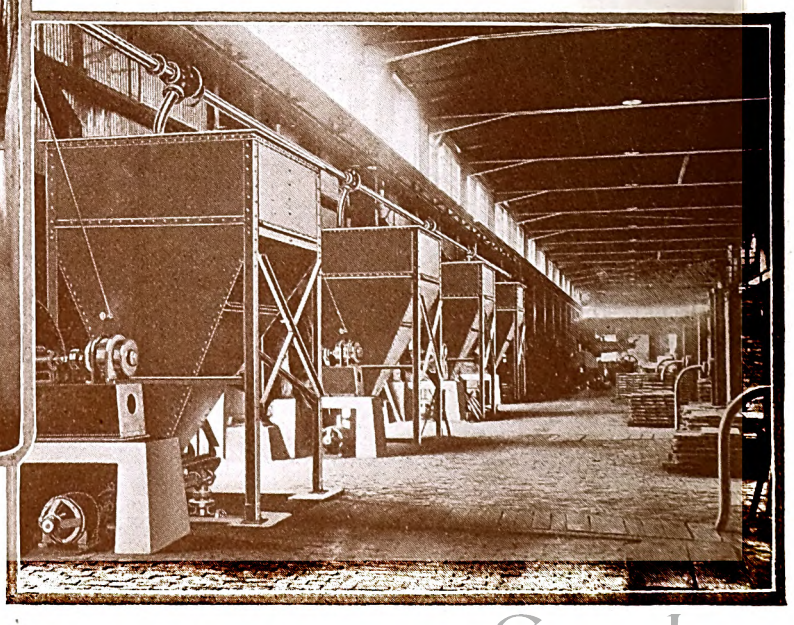


The type of fuel drier shown here may be arranged to use pulverized coal as fuel, or it may be fired by hand grates. This drier consists of an inclined cylinder, into which coal is fed at the upper end, passing to the lower end as the cylinder revolves. Hot gases pass around the sheet and dry the pulverized coal within.

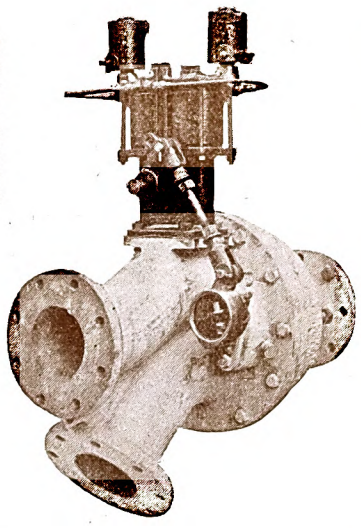


In this type of pulverizing mill, the coal is reduced to a powder by centrifugal grinding action of four large iron balls. Lump coal is fed into the mill from the bin overhead.

In this system (below) pulverized coal is delivered from a distributing or circulating pipe line to individual furnace bins, which are fitted with "high" and "low" point indicators to show the amount of fuel in the hopper.



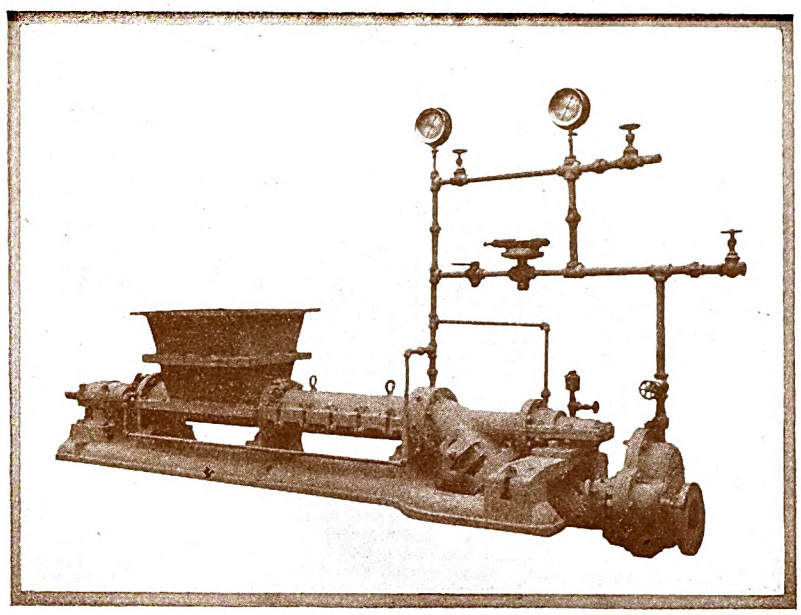
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One type of distributing valve is of the disc multiple port discharge type and is electro-pneumatically controlled from a convenient point. The possitive action of the valve prevents flow past the ports which are in close circuit, at the same time allowing unobstructed passage through the open main.

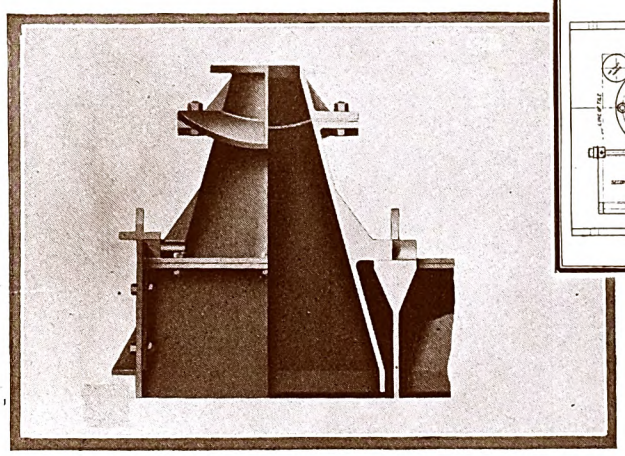
The generation of steam for power, heating and process work has been no exception to this rule. Consequently, the history of the past few years has been one of improvement in existing power plants and of the introduction and installation of particularly efficient equipment in new plants. Not the least in importance in this phase of improvement in the field of power has been the stride taken in the development of pulverized coal-burning equipment, not only for use in heating furnaces and the like, but also for use in boiler installation for the generation of steam.

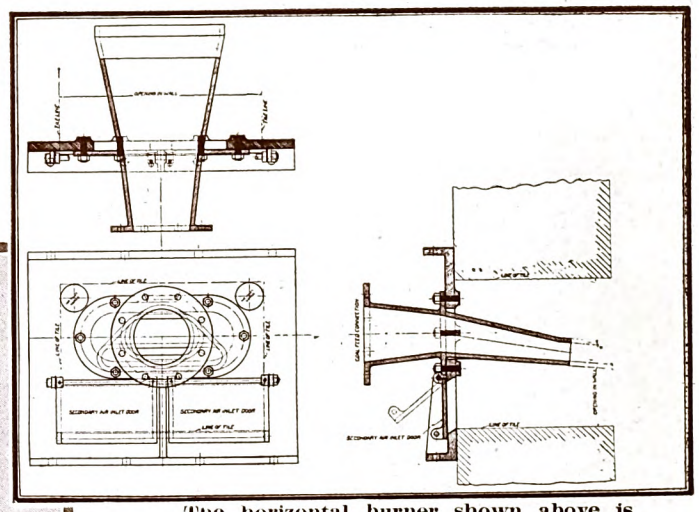
One of the outstanding installations of this nature is the River Rouge plant of the Ford Motor Company, fully described in recent issues of INDUSTRY ILLUSTRATED. Many other plants have been equipped for utilizing this class of fuel and the success that has attended these installations commends them to the careful consideration of managers and executives, because of the unusual economy of operation, elimination of smoke, ease of handling fires and ashes during peak loads, low draft requirements, small stacks and general plant cleanliness.



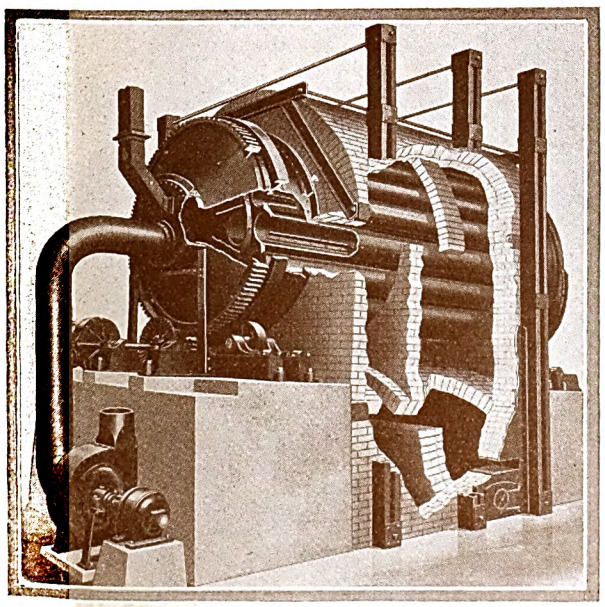
This pump consists of a 6-inch worm which is capable of handling upwards of 20 to 50 tons of pulverized coal an hour. The mass of fine coal is started in motion by the screw which revolves in a closed barrel. Air is supplied for carrying the dust to the points of consumption at from 15 to 45 pounds pressure, depending on the length of the pipe line.

Vertical type burners (below) are adapted to boiler furnaces, providing plant design permits. These burners are used in multiple according to the size of the furnace and the capacity which the boiler must develop. Due to the preheating action of the reverse flow of gases on the steam of fuel from a vertical burner, it is suited to the burning of low-volatile coals.

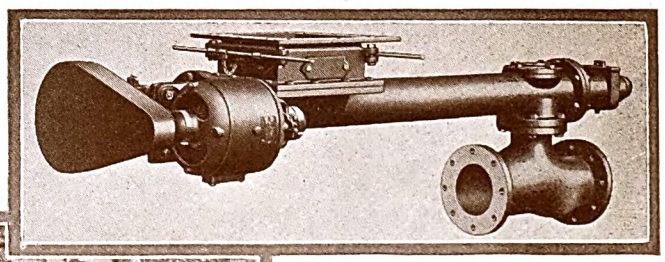




The horizontal burner shown above is generally used on rotary kiln furnaces. The mixing chamber may be attached to the discharge end of the feeder or it may be connected to the flange of the burner. Air inlet doors are provided to permit infiltration of secondary air for complete combustion. It is impossible to burn low-volatile coal successfully with a horizontal burner of this type.



Crushed coal is fed into the tubes of this rotary drier, which is inclined to feed the pulverized dust slowly toward the discharge end. Heated gases pass around and through the tubes to dry the coal, circulated by the draft of an exhaust fan.

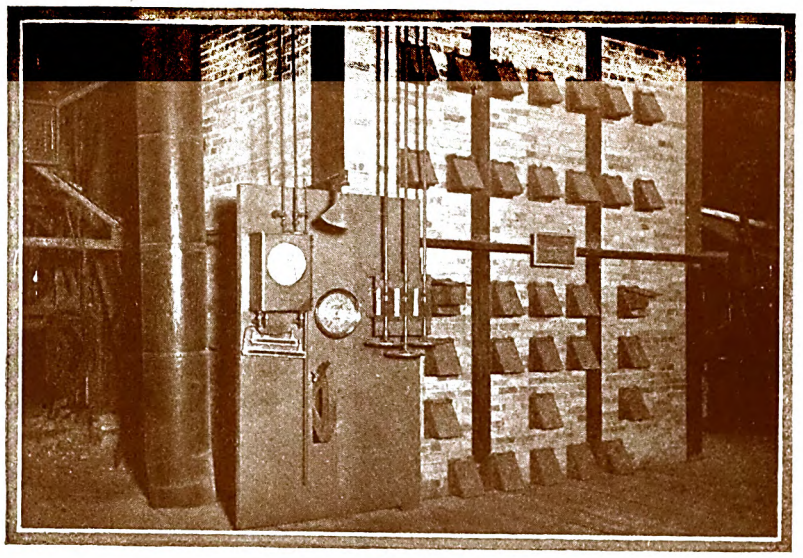


Pulverized coal is delivered from the screw feeder to a mixing chamber, often located at its discharge end, where it is mixed with air from a low pressure blower, becoming intimately mixed and thoroughly separated before combustion in the furnace burner.

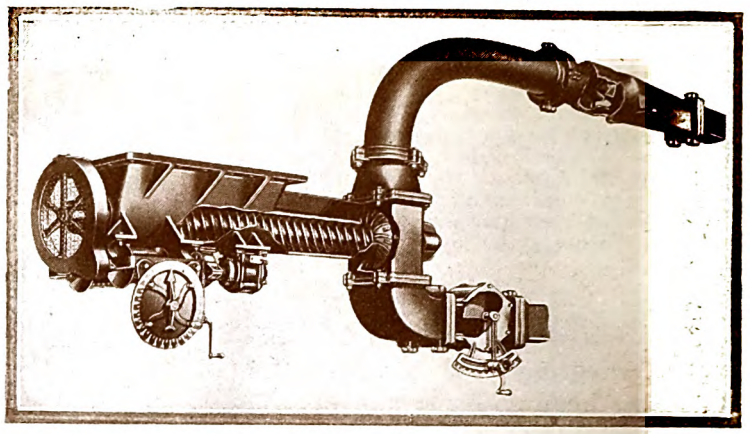


The necessity for a suitable means for removing foreign material from coal is emphasized by this picture of a few odds and ends that come in the usual car of coal. Usually this is accomplished by a magnetic pulley or other device which attracts and holds iron and steel bolts or bars, such as are seen here.

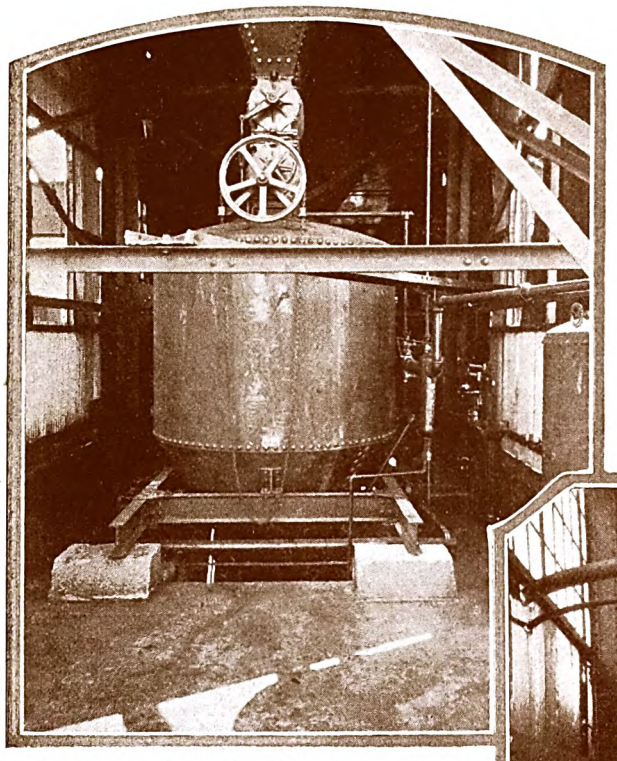
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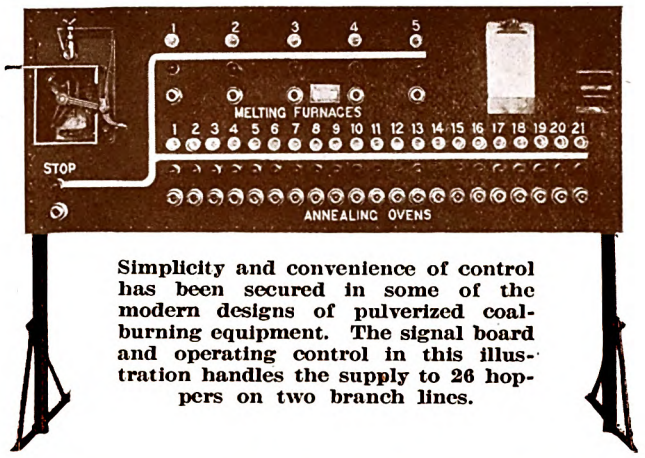
View of the instrument and control board in a pulverized coal-burning plant. The condition of the fires and capacity of the boilers are at once visible and adjustment can quickly be made which will influence the combustion and increase the boiler's rating.



This type of powdered coal feeder is ready for operation with the exception of the storage hopper and air supply. Power is supplied by an electric motor driving through a reduction gear set and variable speed transmission. Coal supply can be regulated in fractions of an ounce per minute.



Part of a powdered coal conveying system, showing valve operating mechanism and weighing tank mounted upon a scale. The capacity of this system is 20 tons of coal an hour, delivering powdered coal to 40 hoppers through a conveyor line 1,300 feet long.

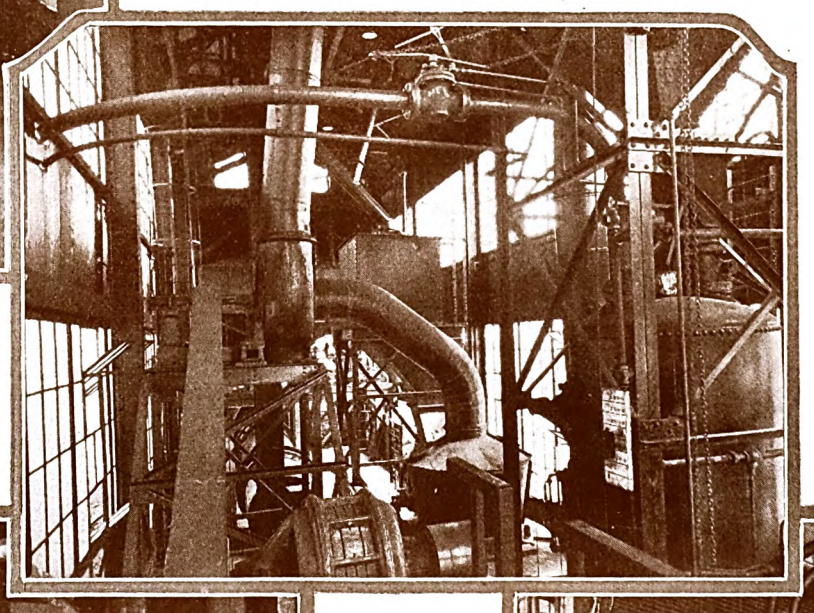


Simplicity and convenience of control has been secured in some of the modern designs of pulverized coal-burning equipment. The signal board and operating control in this illustration handles the supply to 26 hoppers on two branch lines.

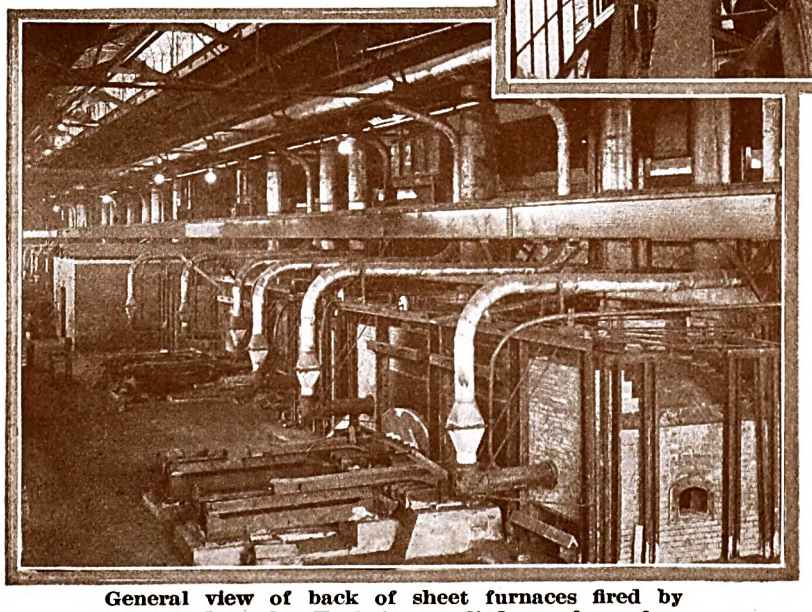
The principle underlying the burning of powdered coal is simple. To burn an ordinary lump of coal completely it must be surrounded by sufficient air for combustion and must be heated to the proper temperature. Since the air necessary for burning cannot reach the core of the coal until the outer surface has been burned away, it is evident that the speed of burning must necessarily be somewhat retarded.

When coal is pulverized, however, each infinitely small particle of the fuel is sur-

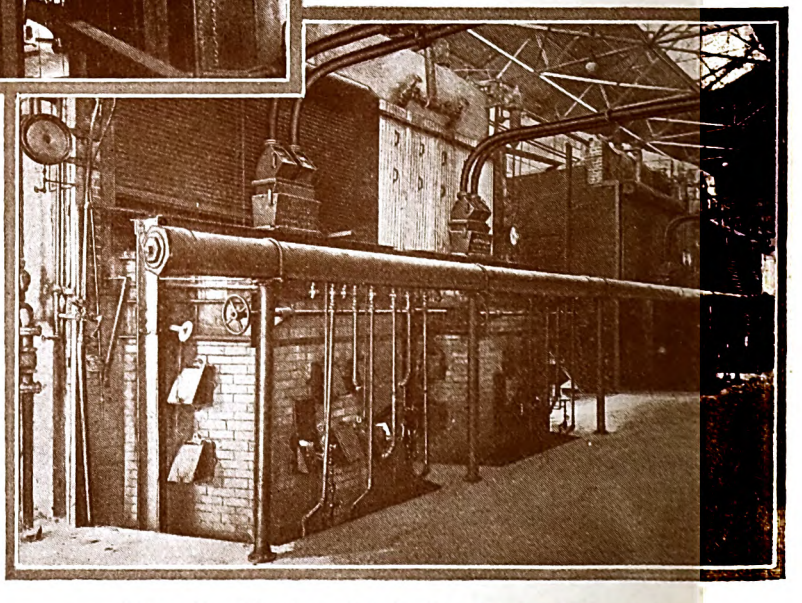
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At the left—Interior view of a large pulverizing plant, showing the top of the blow tank and the full distribution line in the foreground at the top. The chain at the right runs over sheaves to operate the valve. The amount of fuel in the bin over the blow tank is shown by the indicator board, also at the right. Pulverizer and exhaust fans, with their motor drives, are seen in the center of the picture.



General view of back of sheet furnaces fired by pulverized coal. Fuel is supplied to these furnaces from bins through the small pipe line branches which are seen (marked in white) directly under the much larger pipes which supply the air required.

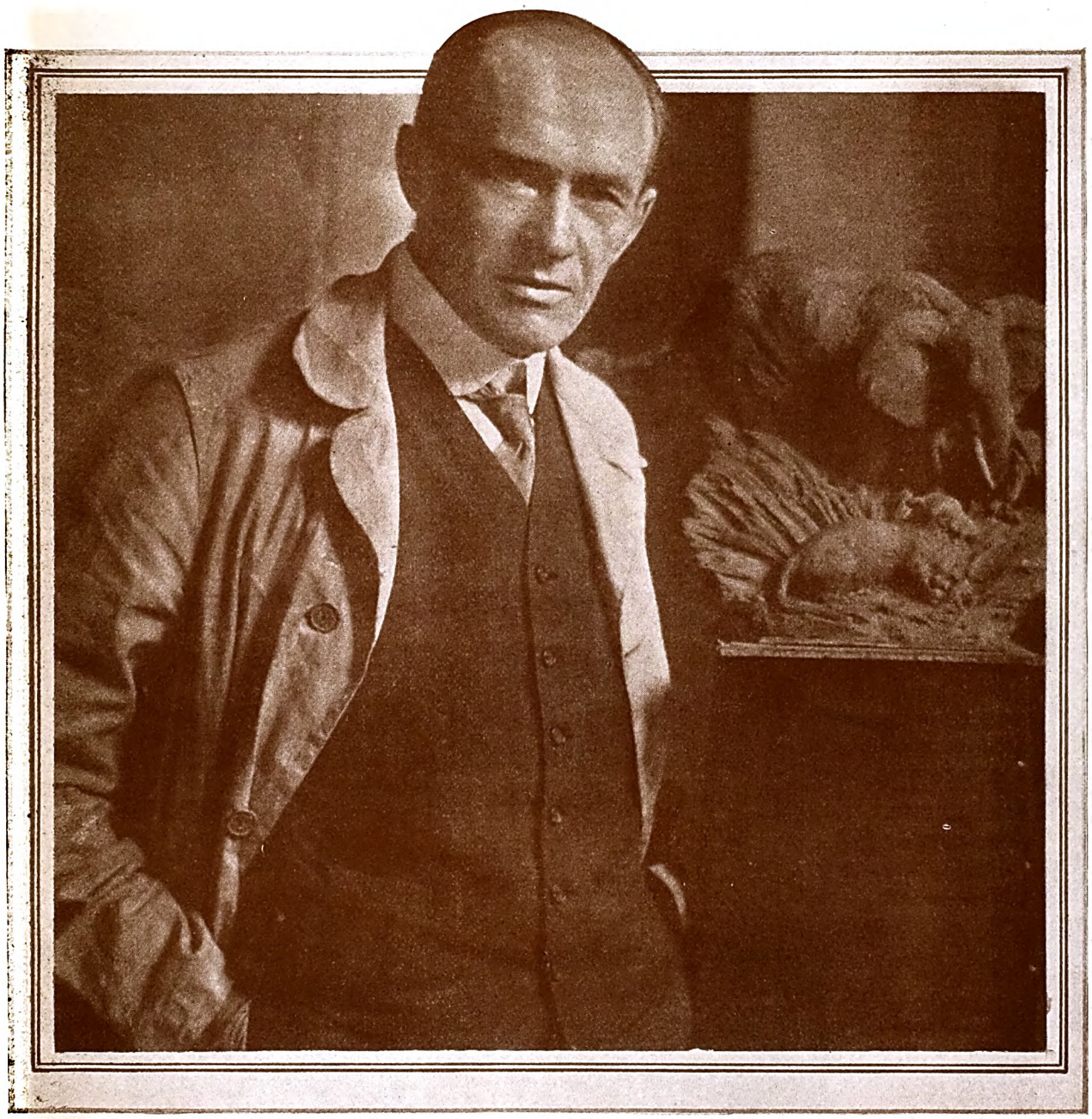


How the interior of a boiler room looks when equipped for burning pulverized coal. Note the cleanliness of the installation. Piping is located well overhead and the system is characterized by its ease and convenience of control.

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Shooting Big Game, Pictures, and Cement

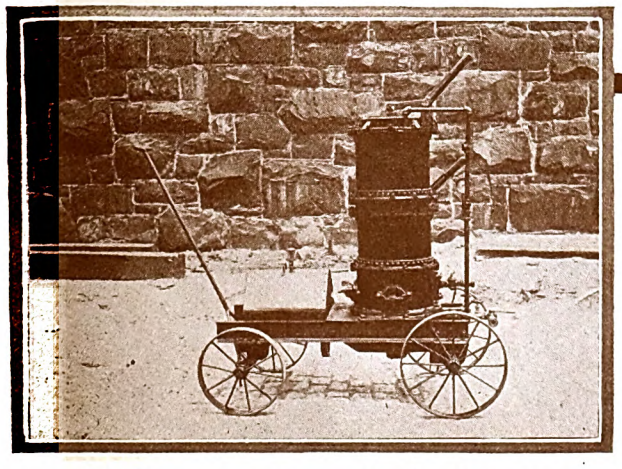
By Ernest H. Rowe



Carl Ethan Akeley—Supergunman, Sculptor, Inventor.

THE life stories of some men resemble a railroad track. They travel fairly straight from a starting point to a destination. Everything important they do moves on that track. But here is a man whose accomplishments are better represented by a tree. There is a trunk, a major interest rooted deep in the soil of early life, growing unswervingly upward. But also there are branches which, while they spring from it, spring away from it, grow off in different directions, bearing various fruits. His business card for forty years has read, "Carl E. Akeley, Taxidermist." At least he had some printed that way when he was a sixteen-year-old boy, and he could use them still. But how completely he has revolutionized the connotation of the word! When the upholsterer around the corner got enough work stuffing deceased Fidos and poll parrots or canary birds, he scrawled a cardboard sign, "Taxidermist," for his window—and he had a perfect right to the title. Upon Carl Akeley, in 1916, membership in the National Institute of Social Sciences of New York was conferred "for making taxidermy one of the arts." For *making* it, notice. And an *art*—notice that.

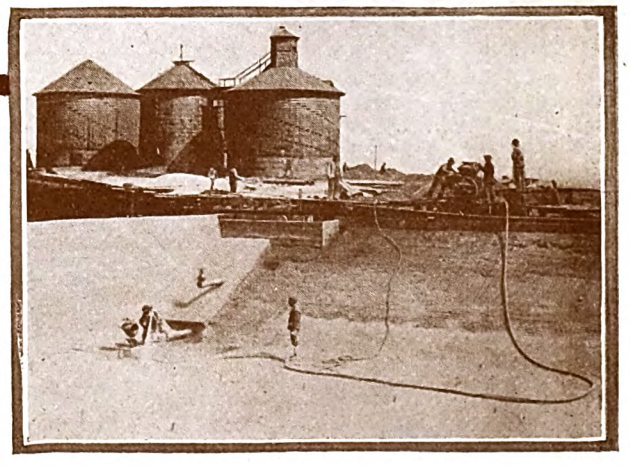
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The "cement gun" was developed to some extent from the machine Mr. Akeley had made for his own use in coating with cement or plaster of paris the animal manikins on which skins were mounted for the Field Museum



Side view of the Akeley camera. It looks different, and it is different. With the one control "stick" it is moved smoothly in every direction so as to follow the movements of wild animals and birds.



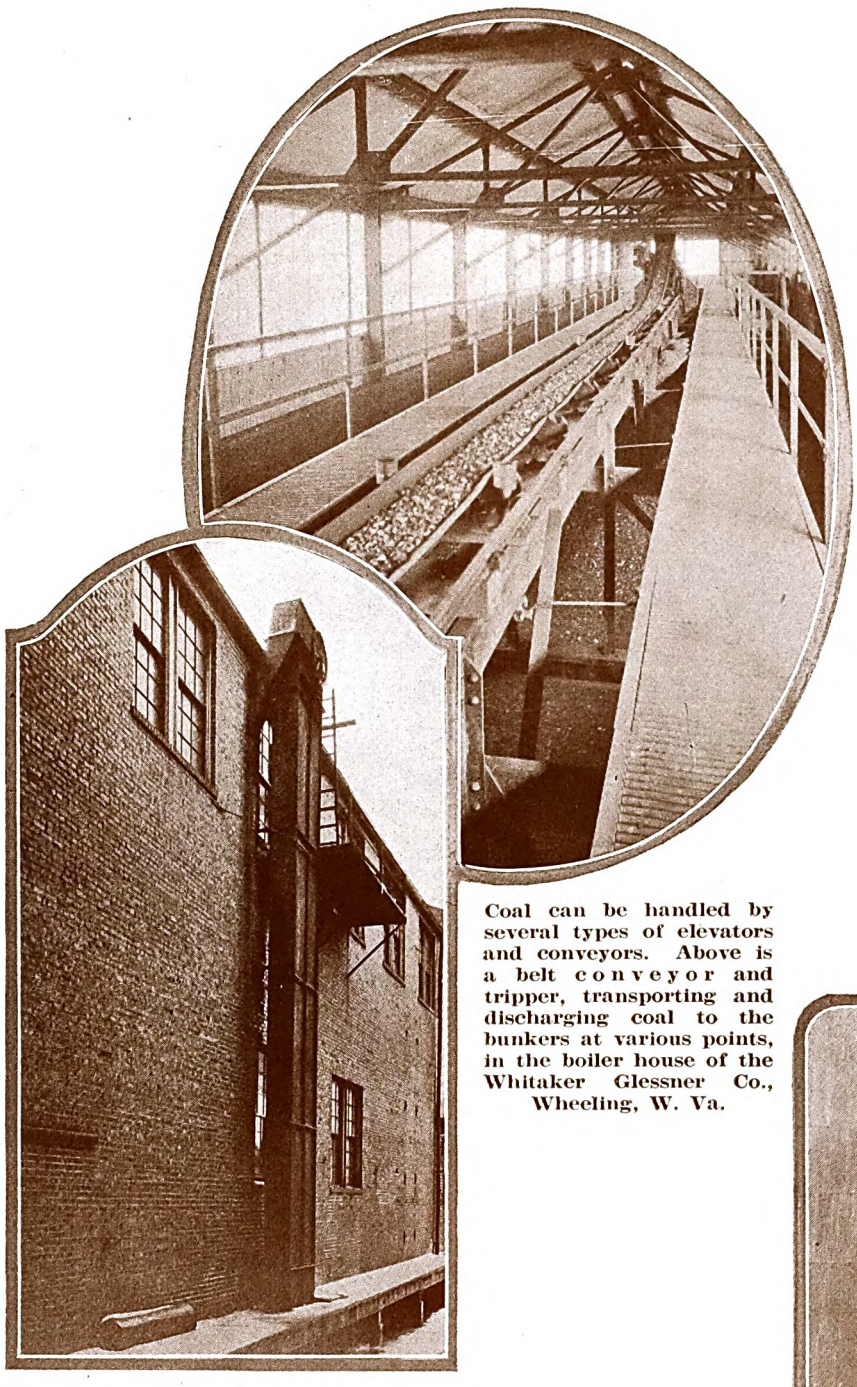
Heavy work. Building a great reservoir of "gunite" at the Anaconda copper mine, Great Falls, Mont.

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Moving Mountains Without the Shovel Gang

Handling Bulk Materials at Half the Cost

By Matthew W. Potts



Coal can be handled by several types of elevators and conveyors. Above is a belt conveyor and tripper, transporting and discharging coal to the bunkers at various points, in the boiler house of the Whitaker Glessner Co., Wheeling, W. Va.

THE handling of bulk materials was the deciding factor in the development and use of elevating and conveying equipment. It has been found, in practically every industry, that the wheelbarrow and dump-wagon are inefficient when large quantities of materials have to be handled over a given route.

When such a condition exists it is generally possible to install some type of elevator or conveyor to handle the material. This equipment has many advantages over the old hand methods, foremost of which are reduced cost and high speed and dependability. For illustration we will take the experience of a brick manufacturer at Dayton, Ohio, whose general manager says:

"The operating cost of this conveying equipment is 54 per cent. less than our former costs; it displaces six men and saves a total of $3902.14 a year in wages alone. Though used only 3 or 4 hours a day, they average 150 tons of material a day. The machines have also reduced our labor troubles, which were unusually serious because of the disagreeable nature of the work.

"We are manufacturers of sand-lime brick and roofing tile. About three years ago we installed the loader and conveyor shown. Since the installation was completed we have never had to shut down our plant for lack of materials, though such shortages formerly caused expensive tie-ups.

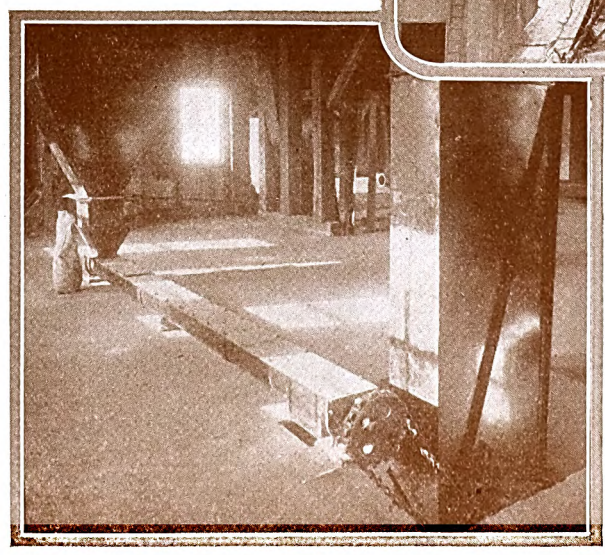
"The operation is very simple. First the material is dug out of the bank by the loader and discharged onto the portable conveyor. This discharges onto the long conveyor which carries the material directly into a storage bin inside which holds 125 tons. This conveyor is adjustable in length from 250 to 350 feet.



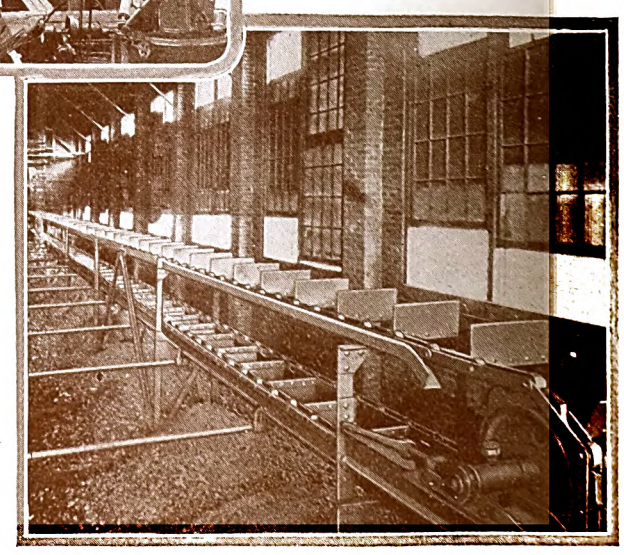
Another use for bucket elevators is in the raising of grain from the hold of the ship to the grain elevator. This installation was made and is operating at the Dock Board Public Grain Elevator in New Orleans. These elevators handle hundreds of tons of grain per hour.

While coal can be handled with a belt conveyor, it is also economical to use a flight conveyor. In this equipment a tripper is not necessary as the material is conveyed in the trough and discharged through gates, or openings in the bottom of same.

The centrifugal discharge bucket elevator will elevate materials for heights of more than one hundred feet. This one in the plant of the Van Camp Packing Co., Louisville, Ky., is handling coarse salt used in making soap. The salt is shoveled direct from the car to the boot hopper opening in the platform; the elevator buckets carry the material over the head sprocket and discharge their contents into the spout passing into the building.



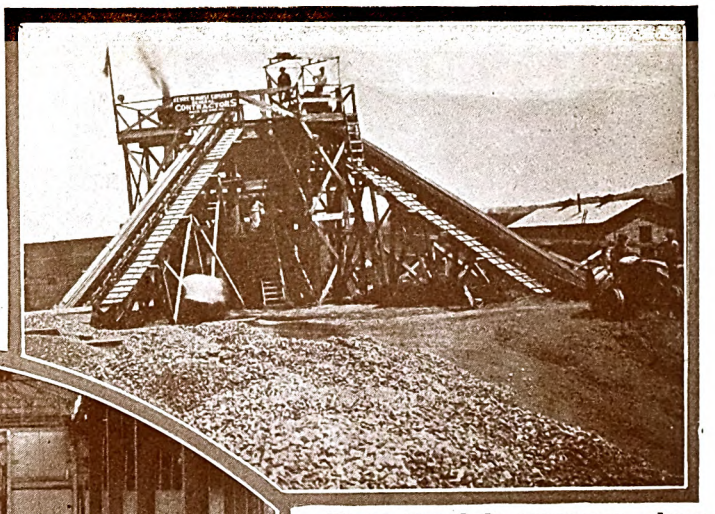
Another piece of equipment that will easily handle bulk materials is the screw conveyor. Building construction often necessitates the use of a conveyor as shown. Here, we are conveying lime from the storage hopper to a bucket elevator.



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While conveyors are not recommended as elevators, they are often used as such. This flight conveyor is elevating coal from a track hopper to a conveyor which distributes it to the proper bunker.

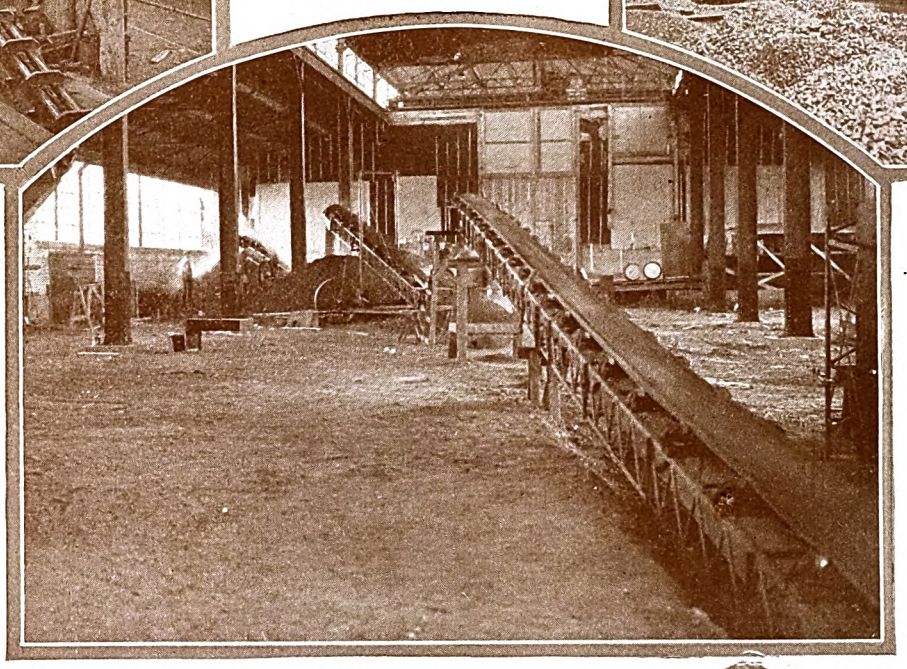


These two belt conveyors, above, are each 72 feet long and are handling sand and gravel. Previous to their installation a stiff leg crane was used. The conveyors have proved more efficient. The tractor pulls a drag line to get materials from storage piles when trucks don't arrive regularly.

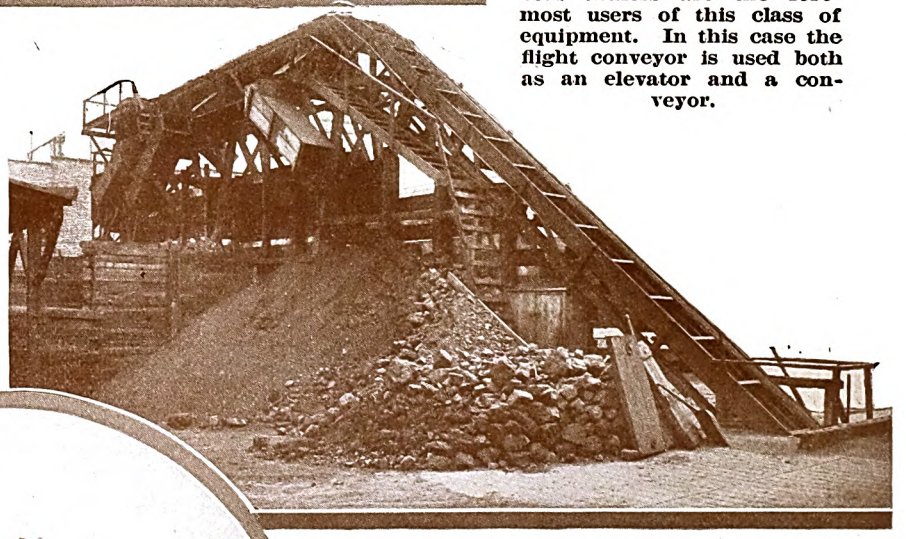
"The cost of operating the machines is very reasonable. We estimate their life at ten years. Repairs and maintenance have been so very low that $100.00 a year on the loader and $50.00 on the conveyor are ample."

Many other installations have been made with the same results. Looking at the many illustrations shown on these pages it can readily be seen that this type of equipment is doing what it would be impossible to do with man labor. Also note the diverse materials handled and the various industries in which this equipment has been installed.

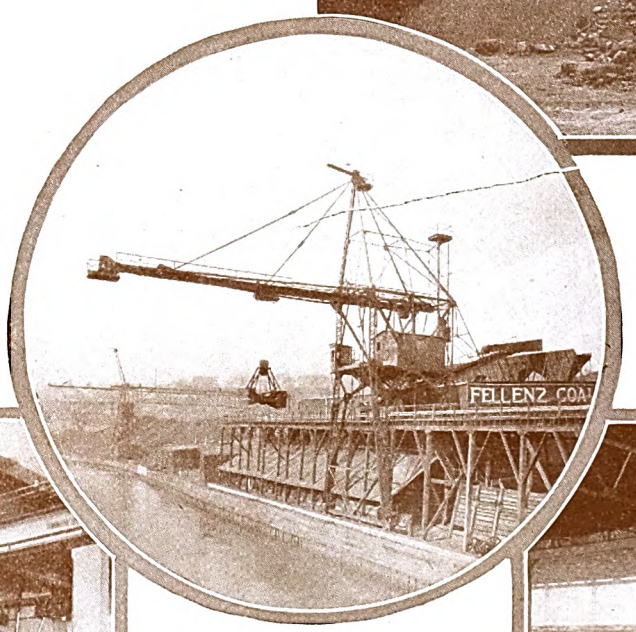
Take the raising of grain from the hold of the ship into the storage elevator. How would a gang of men go about this task and how long would it take to unload the ship? It is necessary for these ships to be kept plying between ports and fully loaded if they are to make money for their owners. This necessitates quick unload-



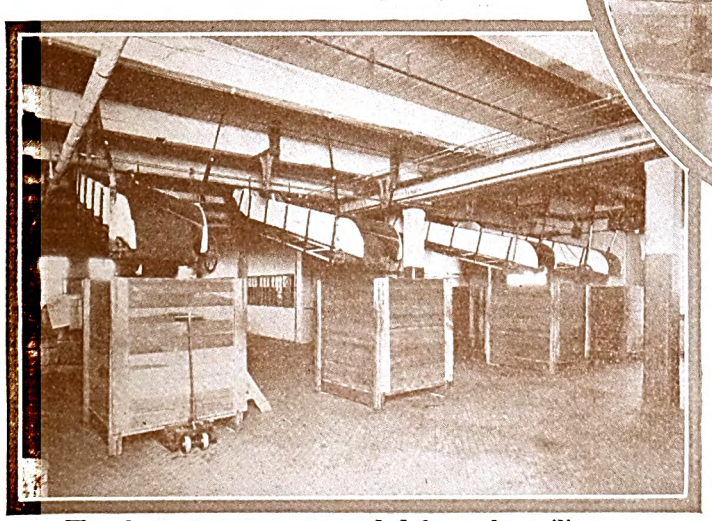
It is seldom that a manufacturer uses his own equipment. This shows a conveyor manufacturer doing what he has often recommended others to do. The conveyors shown above are handling cinders for making a fill in a newly constructed building.



Below—Small commercial coal dealers are the foremost users of this class of equipment. In this case the flight conveyor is used both as an elevator and a conveyor.



Bulk materials are received in ships, cars and trucks. The use of material handling equipment permits quick unloading of all three. The 3-ton bucket and belt conveyor shown at the left will handle approximately 360 tons per hour, from ship to storage.

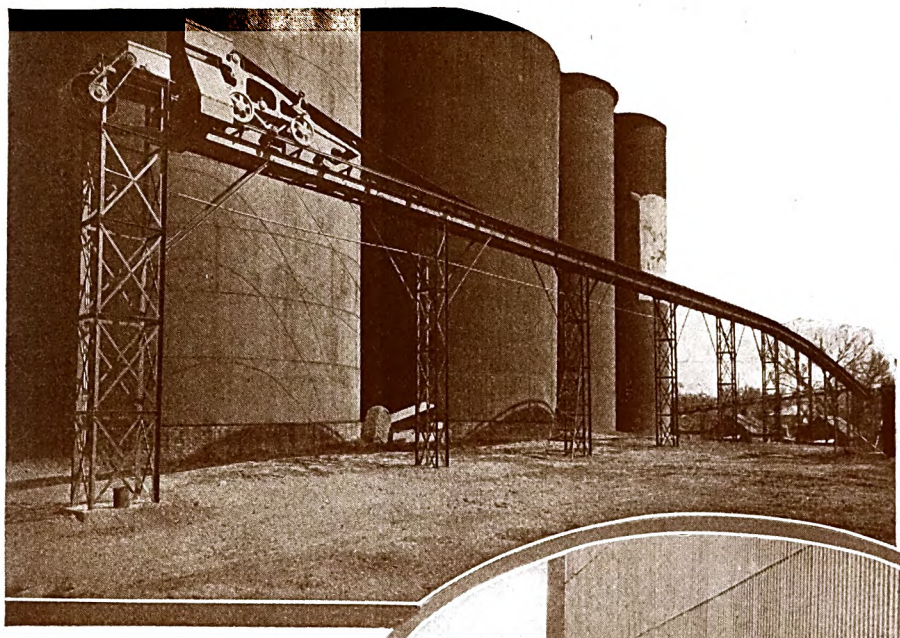


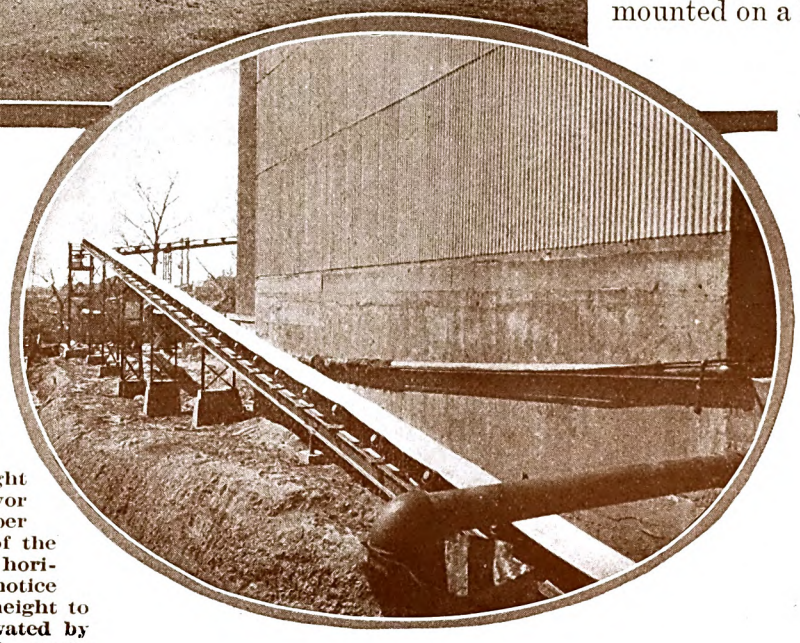
The short conveyors suspended from the ceiling are handling tobacco at the plant of the American Tobacco Co., Louisville, Ky. When the large boxes are filled, a man, by the use of a lift truck, transports them to another department and places an empty box into which the conveyor may discharge.



Loading gas purifier tanks with sand used to be done by a gang of men with wheelbarrows. Today two men and a portable belt conveyor accomplish the work cheaper and quicker.

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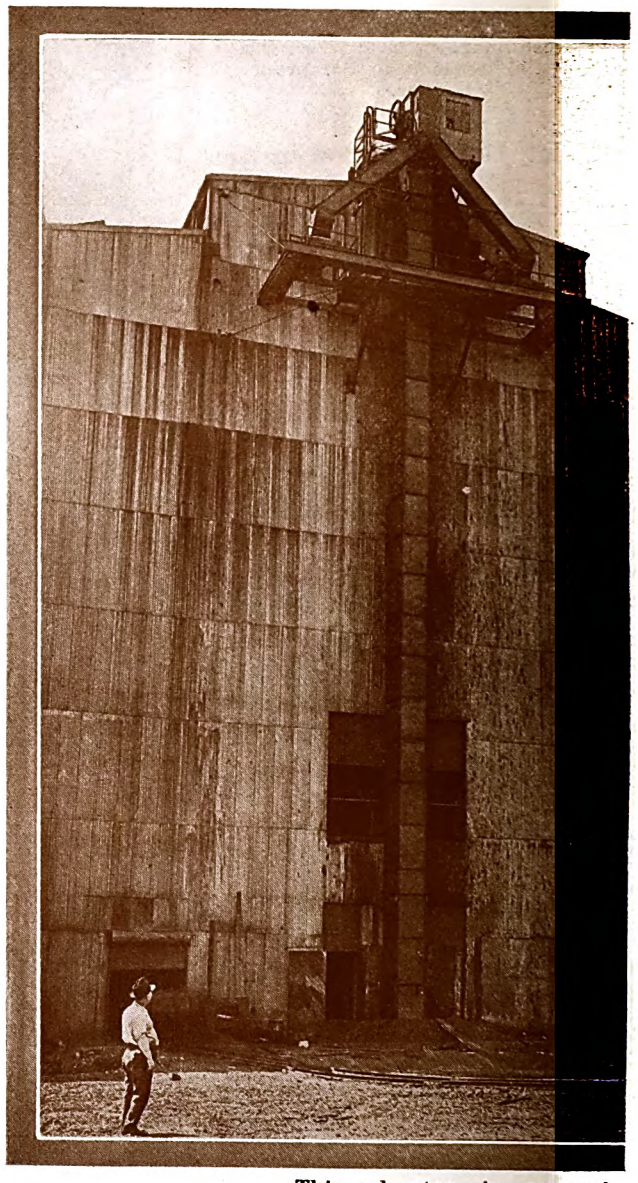
The Morten Milling Co., Dallas, Tex., use two belt conveyors and a tripper for handling their coal from cars to storage pile. The first belt travels from the track hopper to a given height where it discharges to another conveyor running at right angles. The second conveyor is equipped with a tripper which permits unloading of the belt at any point on the horizontal run. The point to notice in this installation is the height to which the material is elevated by means of conveyors, and the angle on which the conveyors operate.

ing and loading. The method of quick loading is also shown.

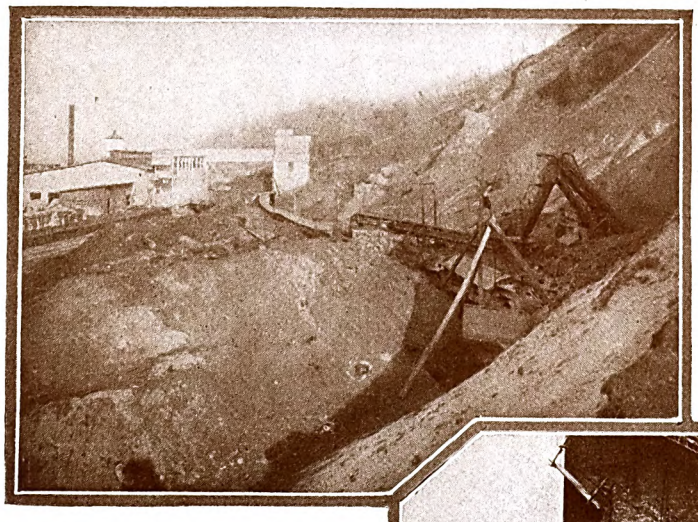
The owners of Lake Vessels have gone far in the development and use of materials handling equipment. Their season is limited and they do not care to spend much of the open season tied up at a dock while cargos are being unloaded. Some of these vessels that operate on the same type of cargo the full season have been equipped with conveyors in the hold and a conveyor mounted on a boom for unloading direct to the storage pile. These are great time and money savers.

Coal dealers are also finding the use of handling equipment a great help at the unloading end as well as the loading end. Today very few commercial coal dealers unload their cars or load their trucks by hand, it is generally done with some form of elevator conveyor.

Gas plants and coke ovens are another field for this equipment, and chemical works

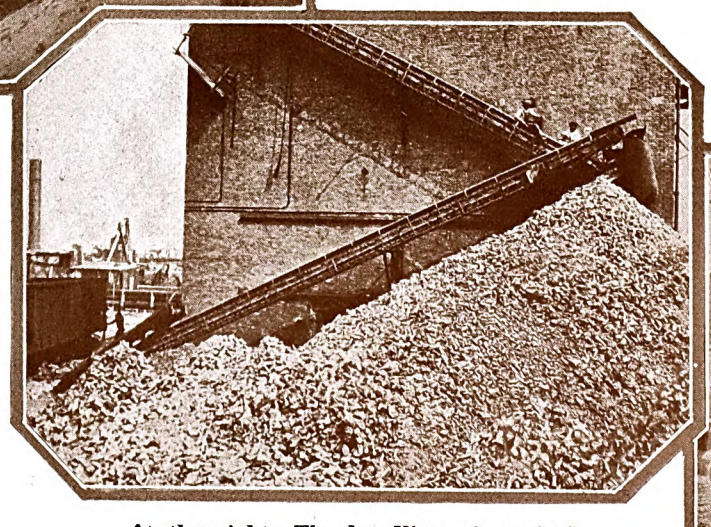


This elevator is approxi- is equipped with a bifurcated either one of two belt con- material lengthwise



This installation of belt conveyors made a saving of $3902.14 a year in wages alone and permitted the plant of the Crome Brick Co., to be operated without danger of running short of raw material as had been the case when hand methods were used. (See text)

With this installation of cleated belt conveyors, the General Carbonic Co., Long Island City, N. Y. is handling approximately 20 tons of coke per hour at a cost of $.4258 per ton. Previous to the installing of the equipment their costs were $.8438 per ton.





At the right—The handling of crushed ice has to be taken care of quickly. Here the ice crusher is located in the basement and feeds to more than one elevator for distribution to various points in the plant.

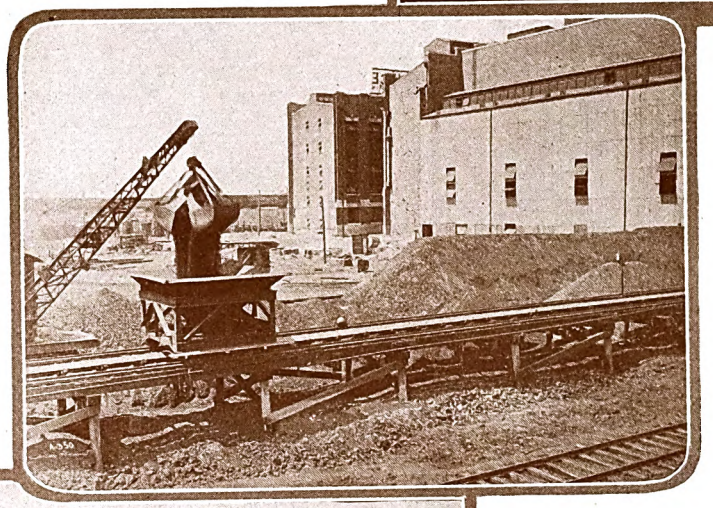
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would be useless if they did not have the various types of elevators and conveyors for handling their bulk products, such as salts, crushed ice, clay, lime, sand, etc., that are used in such great quantities that it would be physically impossible to handle it with the old hand methods.

Looking at the coal storage installation of the Erie Railroad at Croxton, N. J., will give a good idea of the work that could by accomplished by one line of belt conveyor. Can you imagine how many men and how long it would take to place the amount of coal in storage that is shown in these two illustrations, and then how long it would take to reclaim it from the storage pile? The man handling of such a mess of bulk material would have been possible in the days of the Pharaohs, when slaves were in vogue, but in the present day, even if the labor was available, the cost would be prohibitive.

Every day new uses are added to the many old uses of



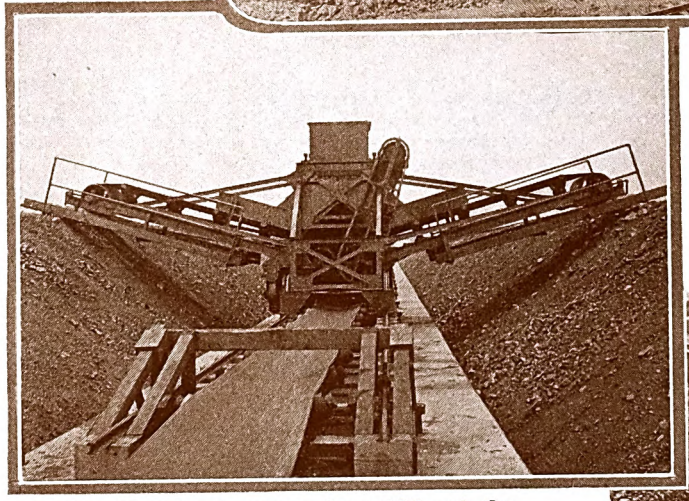


It is seldom that both runs of the same conveyor are made to carry materials. The conveyor shown is in operation at the Edgewater, N. J. plant of the Midland Linseed Co. The upper run of the belt is troughed and carries bulk linseed from the ships to the storage hoppers. The lower run of the belt is flat and well supported by flat idlers, and on this, linseed cake in bags is transported to the dock and ships.

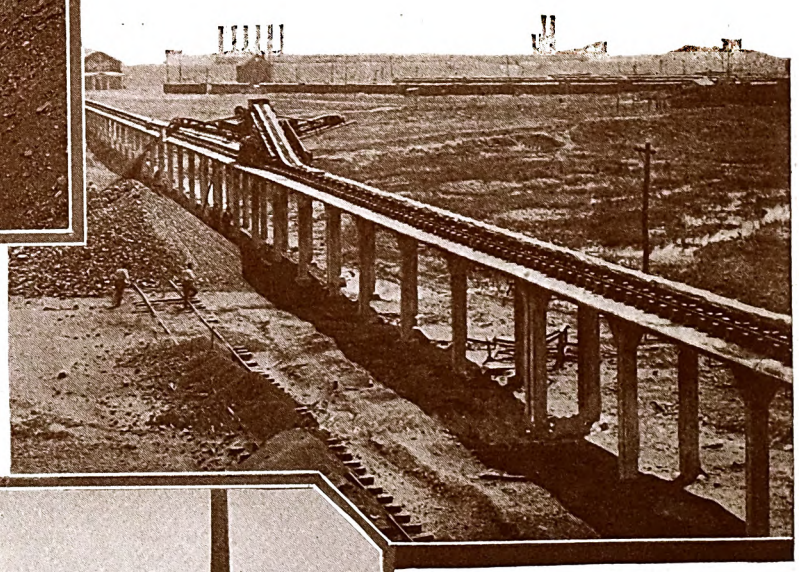
Loading a belt conveyor at various points is sometimes considered a difficult problem. A traveling hopper as shown is quite effective and makes loading easy when a locomotive crane is used for recovering materials from outside storage.

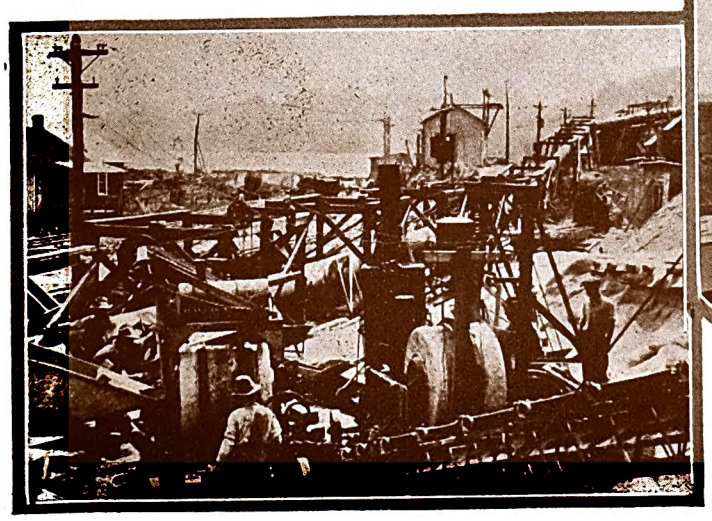


mately 90 foot centers and spout that discharges to veyors that transport the of the building.

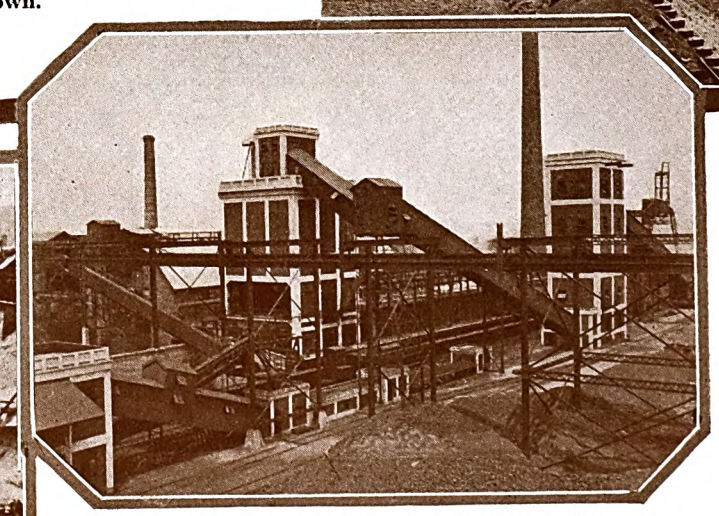


In order to increase the width of the storage pile at the Erie R. R. locomotive coaling station, Croxton, N. J., this "Airplane" tripper was used for unloading the belt conveyor. The two short belts on the wings, and the tripper itself are operated by power transmitted through the load carrying belt. The start of the pile and the length of the run is clearly shown.



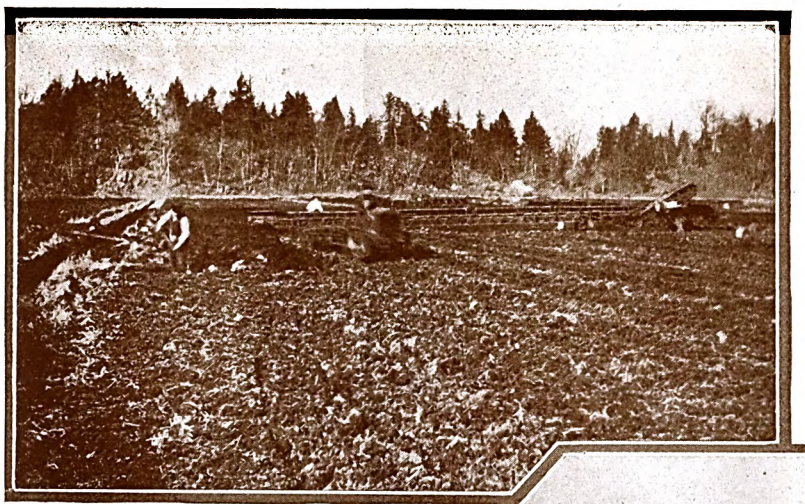


Handling wet concrete is one of the many difficult things done by means of material handling equipment. This belt conveyor will easily handle the full capacity of both concrete mixers shown in the foreground.

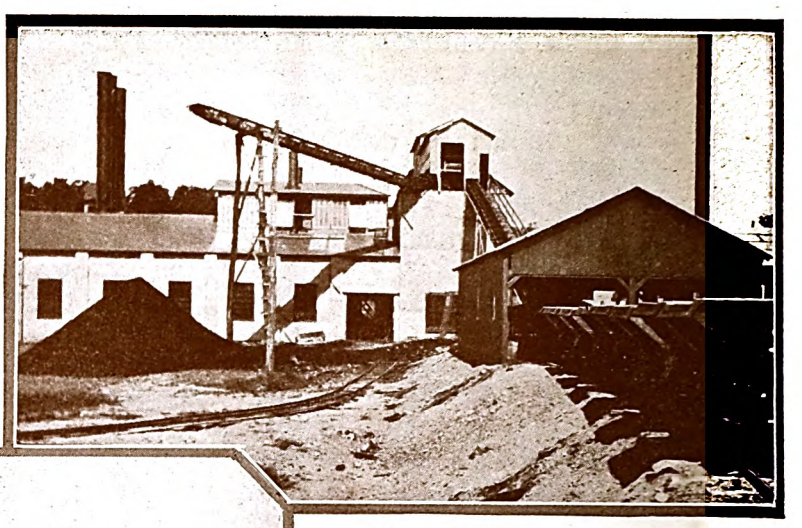


All belt conveyors should be placed in a housing if possible The method of housing is shown in the photograph. Note how the conveyors are used to transport materials between buildings.

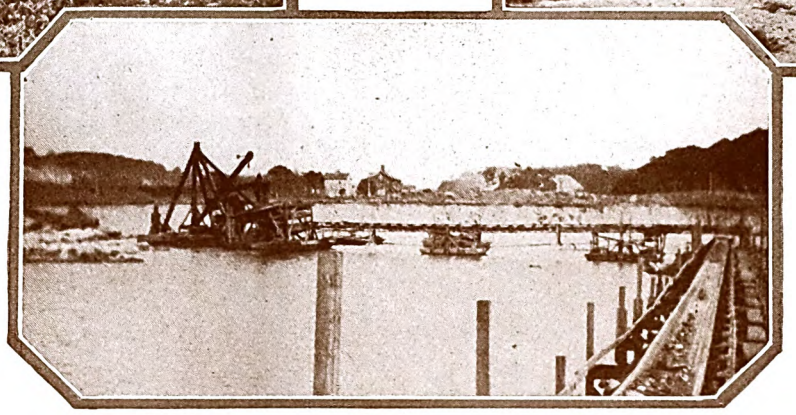
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In Ireland, peat is gathered by man and mule. In this country, conveyors are used to better advantage. After the peat is plowed up it is shoveled directly onto the long belt conveyor which loads it into the industrial cars.



The industrial cars of peat are drawn to the plant and dumped onto another belt conveyor which carries the peat into the plant or to yard storage. With this system the cost of handling is less than 5c. per ton.



Conveyors mounted on pontoons handle wet materials as easily as other conveyors handle dry materials. Here the shovel digs under water and dumps direct to a hopper that feeds the material to the belt.

elevators and conveyors. It was long thought that the only way to handle wet concrete was by means of concrete buggies, but here we have an illustration of an actual installation, where one belt conveyor will easily handle the capacity of two concrete mixers, and at the same time transport the load on an incline.

Other illustrations show how contractors and others are using the conveyors for handling wet materials, and now after many years of experiment, a belt has been made that will carry hot materials.

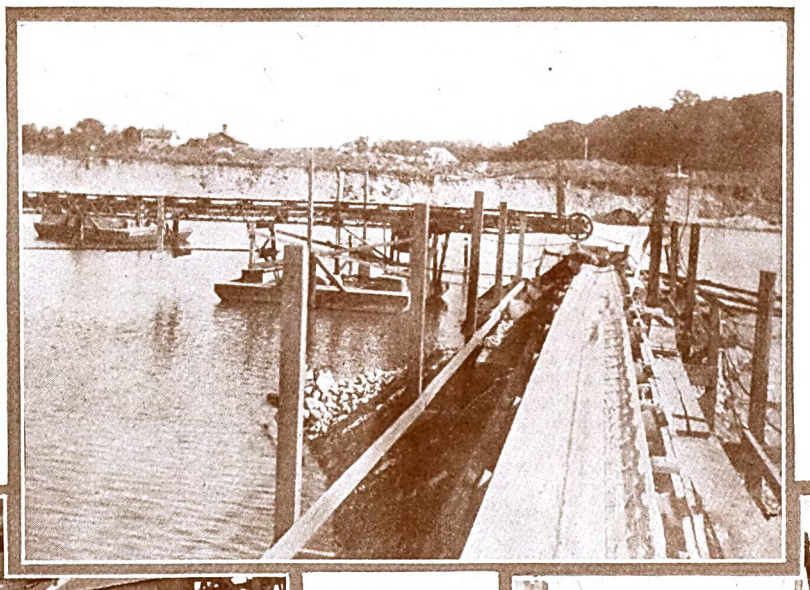
Judge Gary, in a recent interview, made a plea to allow more immigrants to enter the country, as a serious shortage of manual labor already existed. Think how many men could be released for more productive labor if elevators and conveyors were permitted to handle *all* bulk materials, and in addition to the releasing of these hundreds of thousands of men, there would be a saving of millions of dollars each year.

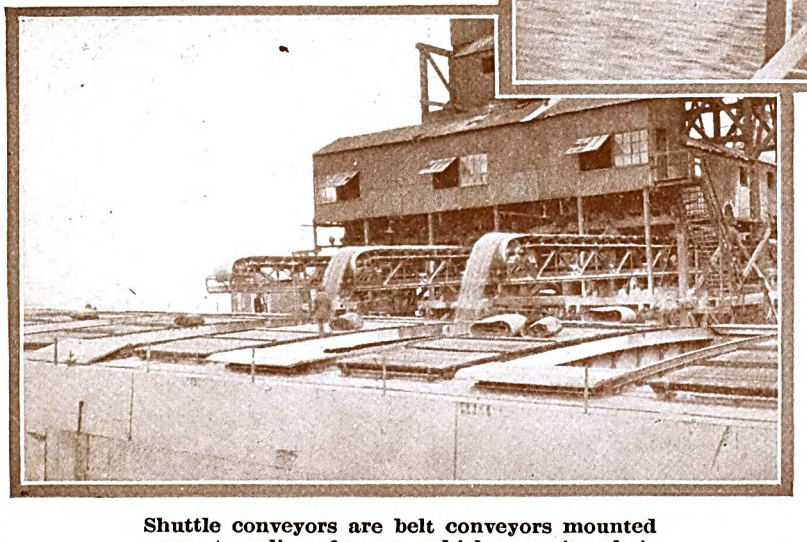
It was during the high production period of the war that materials handling equipment made its biggest strides; and more installations were made during these few years, than had ever been made over all the years previous. In fact, the demand for this equipment was so great that the manufacturers had to enlarge their plants in order to fill their orders.

The time to make improvements in the production plant is not when production is at a peak, but the improvement should be made prior to this peak load. For this reason, plant managers and production managers should right now be giving serious thought to their handling problems.

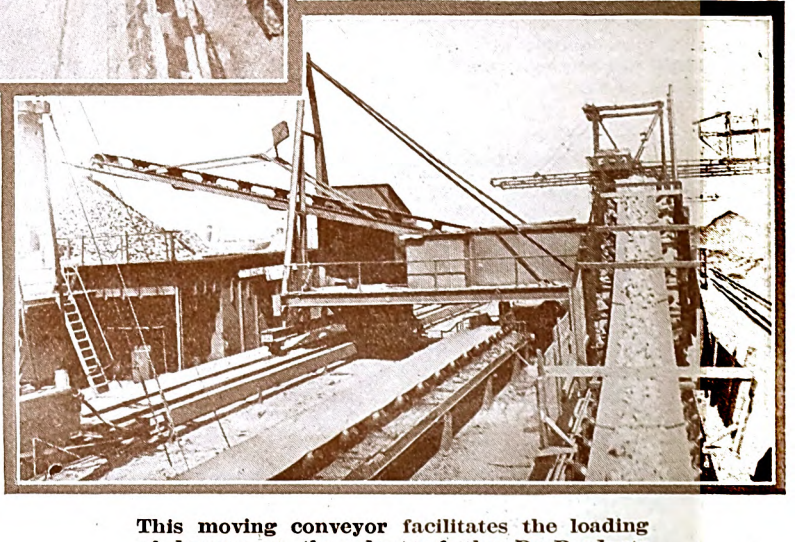
The labor situation makes it imperative to take steps immediately to prevent a serious curtailment of production. The present shortage can only grow more acute.

This view, below, shows more clearly the way the conveyors are mounted on the pontoons and how one conveyor discharges to the other at the same time changing the direction of travel.





Shuttle conveyors are belt conveyors mounted upon traveling frames, which permits their being moved backward and forward in a given line of travel. These three shuttle conveyors trim the load without the use of man labor.



This moving conveyor facilitates the loading of barges at the plant of the By-Products Coke Co., South Chicago.

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How to Eliminate Glare and Yet Enjoy Benefits of Needed Daylight Illumination

By T. T. HOLT, President of The Skybryte Co.

FOR years our organization has been working to perfect a product that would eliminate glare from factory windows and skylights and reduce the temperature of daylighted interiors.

The need of such a product was only too apparent. The price that industry was paying each year because of glare was appalling. We found by research work that one of the main causes of fatigue was the tiring of the optic nerve. Too close work of course, causes this but far too often it was caused by glare. This tiring of the optic nerve by glare sapped the strength of the workmen. It made them listless, sleepy and careless. And this of course, resulted in lessened production, more spoilage and an increase in accidents.

After we realized the need for a product to eliminate this glare we made a research among industrial plants to find out just what qualities were needed in this product to make it adaptable for industrial use.

This research showed that it would have to be a product that while diffusing the light and eliminating the glare would not appreciably reduce the lighting. It also had to be a product that would not rub off or flake off; one that would not be washed off by rain when applied to the outside of glass, and yet one that could be easily removed by warm water when desired. Then, of course, it had to be easy to apply and economical.

We finally perfected a product that came up to these specifications — we call it SKYCO No-Glare.

The product is slightly blu-ish in appearance. It diffuses the direct rays of the sun, absorbs much of the heat rays and modifies daylight to an ideal, cool, restful color. It transmits the kind of perfect lighting that has been striven for for years by much more expensive means.

The cost of SKYCO No-Glare is so trifling and its results so satisfactory that we are anxious to have every industrial plant in the country know about it thru actual experience. We are glad, therefore, to send a one pint sample (enough to cover about 80 sq. ft. of glass area) with our compliments, to any manufacturer. Just ask for free sample of SKYCO No-Glare. Address The Skybryte Co., Bangor Bldg., Cleveland, Ohio.



Before cleaning glass with Skybryte and with no electric lights burning there was only 7/10 feet candle illumination.



Before cleaning glass with Skybryte but with three 100 Watt Type "C" lamps burning illumination amounted to only 2 1-2 ft. candles.

These Same Results in Your Plant, too

DOES proper daylight illumination really increase production? Does it lessen accidents and spoilage? Does it actually pay in dollars and cents to keep glass clean? Is it easy and economical to do so with—

Skybryte CLEANER (LIQUID)

The pictures in this message are your answer. They are unretouched photographs taken at the Ferro Machine and Foundry Co. of Cleveland. They prove the amazing difference that dirty and clean glass makes in illumination.

No Skilled Labor Necessary

An unskilled laborer dips a brush in Skybryte and coats the dirty glass. Almost instantly the hardened crust of rust, carbon scale and soot is loosened. Then he flushes off with water. The glass is clean. Daylight floods your plant.

After cleaning glass with Skybryte and with no electric lights burning, light meter indicated 15 ft. candle illumination. This was an increase of 600%.

Costs Less than ¾c per sq. ft.

Five gallons of Skybryte cleans 4000 sq. ft. of dirty glass. An unskilled laborer can clean 5000 sq. ft. per day. The average total cost of cleaning including labor and material is less than ¾c per sq. ft.

FREE! Valuable Interesting

A scientific treatise on natural light written by the world's greatest light specialists. Write for your copy.

Write for Trial Offer

Skybryte is guaranteed to win your prompt, enthusiastic approval. We are glad to prove it entirely at our risk. Write for particulars of our trial offer. Also, let us send you names of concerns in your city who re-order Skybryte.

The SKYBRYTE COMPANY, Bangor Bldg., Cleveland, Ohio

Chicago Branch: 20 E. Jackson Boulevard

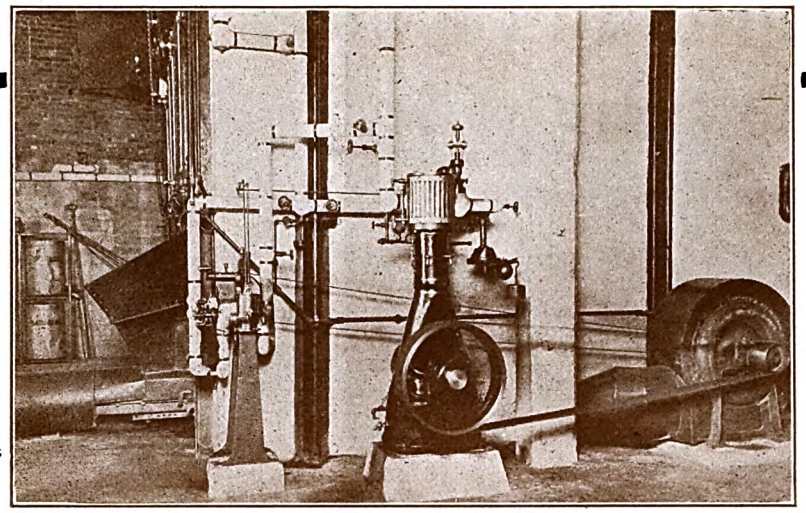
Skybryte CLEANER POWDER

Prepared especially for plain and polished glass. No water necessary. Cleans without scratching. Positively no muss or dust.

SKYCO Sash Paint

An unusually high-grade sash paint. Penetrates quickly and lasts far longer than any other similar paint we know of. It costs more per gallon but less per job.

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Simplifies the Power Problem in the Boiler Room

WHEREVER power is required to drive fans, blowers or stokers in the boiler room, the need is for an engine with the minimum of attention, low operating cost and dependable day after day service

That the Troy Engine is chosen for so many installations where small engines are required is proof of the Troy record of performance.

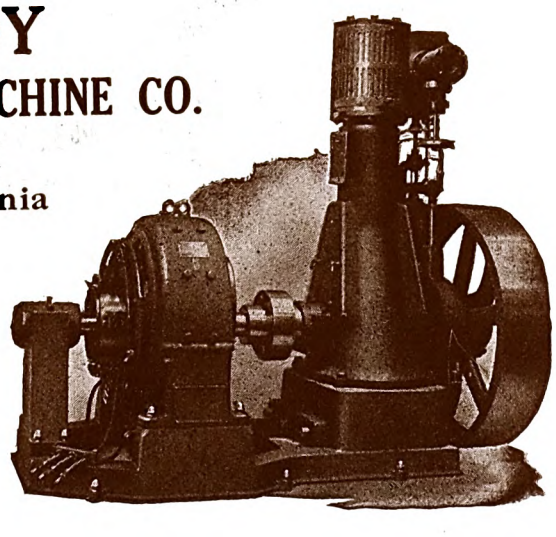
This reputation was built up by 32 years of specialization in the building of steam engines.

Troy Engines are safe engines—the balanced valve remains steam tight and sealed for years. It automatically clears the cylinder of condensate.

Troy Engines are economical in operation—bearings are oiled automatically. Troy Engines last for years—rugged in construction, compact and symmetrical in design.

The Troy Catalog will aid you in selecting the proper type for your requirements. Write for a copy.

TROY
ENGINE & MACHINE CO.
TROY
Pennsylvania



In sizes from 2 to 200 B. H. P.—Vertical, Horizontal, Belted and Direct Connected.

TROY ONLY STEAM ENGINES GOOD ENGINES ONLY ENGINES

New Use for the Bulletin Board

By GEORGE P. HUTCHINS

THE industrial bulletin board is the employer's logical direct advertising medium to his employees for the spread of accurate information and understanding, and the establishment of common though, purpose and action throughout the organization.

The printing press is the greatest motive force in the world today for business, for public opinion, for information and for education. Through the printed word, by the tested methods of advertising, the business executive can well establish a splendid measure of close contact and understanding with his employees. Publicity is just as fully capable of bridging the gulf between a management and its employees as between those same managers and the buyers of their products. A few clear-visioned employers have achieved the result. It is within the reach of all who will make the effort.

This discussion is confined to one medium only of such publicity—the bulletin board, the greatest unrealized publicity asset at the command of the industrial manager where the largest, surest and most direct results may be expected for the least expenditure of time and money.

It is capable of development in every plant until it becomes a positive, constructive influence of inestimable value—a bond of daily contact between management and personnel. It can restore a great measure of the personal touch which executives have lost with workers in large organizations and the loss of which is universally deplored as responsible for so much misunderstanding and hostility. It can be a powerful medium for asserting the employer's natural leadership.

The old precept, "Catch 'em young, treat 'em rough, tell 'em nothing," has long since been cast into limbo as a recipe for labor management. "Labor" may no longer be considered as an abstraction. Successful management finds its greatest success in the response of the rank and file of wage earners to the appeal to reason, intelligence, understanding and innate human impulse toward square dealing.

The one and only successful method of developing the partnership and coöperative spirit in an organization—whether large or small—*(whether that spirit is invoked in the interest of accident prevention, production, wage adjustment, working hours, managerial policies, stability, or loyalty in times of industrial disturbances)*—is to give the wage earners prompt, accurate and sufficient information and understanding such as any responsible business partner fairly expects and feels entitled to receive.

When men fully understand the facts and needs of any situation and clearly sense the trustworthy motives of their employers and executives, ninety-nine out of every hundred can be safely counted upon to be square and to do their part far more dependably than if they are working blindly.

Safety campaigns that show results are "sold" to the rank and file by patient education. The shops where scientific management has been installed with best results found the selling method to work better than the compelling method. The whole success of employees' representation revolves upon participation in responsibility through information. If you want men to work with you instead of merely for you, if you want them on the job instead of merely at the job, *tell them the facts.*

There is no simpler way than through bulletin boards to tell the workers what you want them to know for their own good and yours, what they want to know for their own peace of mind and confidence in you. Consider your personnel—whether it's a hundred men or ten thousand—as so many prospective customers for certain truths you want to

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"sell" them. Inside publicity and good will are exactly as important for efficient production as customer publicity and good will are for efficient sales distribution. Therefore let inside publicity be handled with the same candor, attractiveness and skill as sales advertising.

To make a plant bulletin system 100% efficient, let it follow the recognized principles of first-class sales advertising. Several things unite to give sales-pulling power to advertising — originality, attractive display, omnipresence, striking, interest-arousing features, truth, information value, humor, forceful selling copy, personality, constant change, continuity and repetition.

Human nature is no different when working in the factory than when walking on the street or sitting in the home. Let the bulletin board publicity teem with the same vital appeals which turn business publicity into sales profit dollars. The publicity stake is just as high for the production manager as for the sales manager.

The bulletin board is a valuable medium for six distinct purposes:

1. Safety and health publicity.
2. Plant notices, rules, announcements and general working information.
3. For building morale, organization spirit and pride in the product.
4. For education of a general nature.
5. For the spread of specific information throughout the personnel on all matters of common interest and importance connected with the business or products.
6. For "selling" the management and its purposes to the rank and file of wage earners.

Any well devised and effective bulletin system should combine all six in such proper balance as best fits the needs of each particular group of readers or particular industry.

Why does every literate adult read a newspaper? To know what's going on in the world. The daily spoken or unspoken word on the lips of all humanity every day in the year is: "What's new?" What's new is news.

Of the four great rules for making a bulletin system efficient and resultful, the first and greatest is:—

Rule Number One: Make the bulletin board newsy. Change the matter every day if possible. Keep out of ruts, strive for the element of surprise and the all-compelling impulse of human curiosity.

Make the bulletin board so newsy, so interesting, so attractively composed that the entire body of employees will make a point of looking at them every day in order not to miss something worth while. If the employer or manager will appreciate what a tremendously valuable contact a live bulletin system affords him with his organization, the executive will see that this information service receives the skilled publicity attention it deserves. Workers cannot be critized for indifference to a bulletin system carelessly, irregularly and perfunctorily handled. Bulletin board space deserves to be treated with as much skill as if it were high priced magazine advertising space.

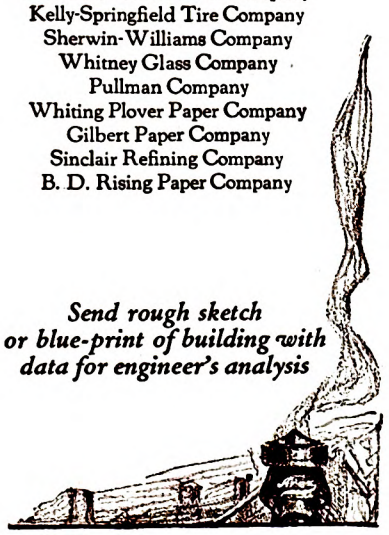




World-known leaders in every branch of manufacturing are found on the list of Arex Installations:

Carnegie Steel Company
Packard Motor Company
Bethlehem Steel Company
American Steel & Wire Company
American Car Company
Ford Motor Company
Armour and Company
Standard Textile Products Company
Studebaker Corporation
Stewart Mfg. Corporation
Semet-Solvay Company
Cadillac Motor Company
Corn Products Refining Company
Crane Company
International Harvester Company
Kelly-Springfield Tire Company
Sherwin-Williams Company
Whitney Glass Company
Pullman Company
Whiting Plover Paper Company
Gilbert Paper Company
Sinclair Refining Company
B. D. Rising Paper Company

Send rough sketch or blue-print of building with data for engineer's analysis



Arex ventilation is practical for an entire plant or a single room

AREX VENTILATION, being independent of expensive and cumbersome power equipment, is practical for the smallest buildings. In single-room power substations where heated air must be quickly removed from the transformers, Arex is indispensable. The specifications of the largest electrical companies in the country demand it.

And by virtue of multiplied savings, Arex ventilation is even more logical for larger projects. For more than fifteen years, Arex engineers have been freeing industrial buildings of every size, of profit destroying conditions—counselling with the executives of every industry to effect savings by the correction of ventilation.

The specification blank below will bring you, without cost or obligation, an analysis of your problem and recommendations by the Arex engineers. Attach a rough sketch or blue print of your building and mail to the Arex Company, Engineering Division, 1583 Conway Building, Chicago.

AREX COMPANY
J. C. Kernchen, Pres.
INDUSTRIAL VENTILATING ENGINEERS

Arex Ventilation Engineering Survey SPECIFICATION BLANK

We desire to receive *Gratis* an engineer's analysis of the following building: ..... *State character of work or business building is used for*

We are troubled with: Fumes ☐ Smoke ☐ Foul Air ☐ Heat ☐ Condensation ☐ Steam ☐

Dimensions of Building: Width.....Ft. Length.....Ft. Ceiling Height.....Ft.

Construction of Building: State whether Brick ☐ Concrete ☐ Frame ☐ Stucco ☐

Type of Roof: State whether Flat ☐ Slant ☐ Gable ☐ Sawtooth ☐ Monitor ☐

Pitch of Roof..... State how many..... inches to the foot.....

Location of Floor or Room to be ventilated.....

How high do adjoining Buildings extend over your Roof?.....

How many feet distant are the surrounding Buildings, or is your Building entirely unsurrounded? .....

....
Firm Name Name of Individual Title of Individual

....
Street Address City State

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Rule Number Two is: Do not crowd the bulletin board. A few quickly read bulletins changed every day are far more effective than crowded boards. Follow the precept: "Be brief, that he who runs may read." The bulletin board should contain no more matter than an average workman can read, comprehend and digest in two or three minutes. What is sacrificed to brevity is always gained in display value and force. Follow billboard publicity methods; use as little type matter as possible, use pictures, diagrams, graphs and cartoons whenever you can. Eighty-five per cent. at least of all humanity is "eye-minded" and does not readily visualize printed words. Photographs or sketches should be employed whenever they can tell the story. The advertising expert knows the value of "white space" around copy. Blank space is equally important for well displayed bulletins.

Rule Number There is: Prepare and select your bulletins as much as possible from the "DO" angle rather than the "DON'T." The science of advertising and the science of salesmanship reiterate that *"affirmation is stronger than negation."* Positive statements always carry greater conviction than negative. Much safety and health publicity (as well as many plant notices) are necessarily of the "DON'T" variety. No manager can teach men caution by scaring them. Men will quit the job if it looks too dangerous and safety engineers know how much turnover is due to the witnessing of accidents and to fear inspiring safety publicity. Precisely the same mental reaction takes place in the matter of disciplinary notices, plant rules and announcements. Faith is infinitely a greater force than fear.

Rule Number Four is: Put a proper portion of humor, warm-heartedness and red-blooded virility onto the bulletin board. Make it good man-to-man selling talk which exudes personality and humanity and a recognition of the heart and intelligence and feelings of the man inside the overalls. Coldly impersonal and anemic communications should not issue on the bulletin board from a well disposed, cordial management to its employees whose good will they are trying to secure. No born leader would address his men in stilted, conventional phrase and measured rhetoric any more than a salesman would so address his customers. If yours isn't the "soulless corporation," which the radicals and agitators assert of all corporations, show its heart and soul to the employees on the bulletin board and make them feel your friendly interest. They want to believe in you and your friendliness but they're sparated from you by many barriers.

You've read advertising with the "personality punch" and brilliant individuality that has won your confidence for goods made by men you never saw. You can sell to the shop confidence in the office and a feeling of all-pervading personal interest in exactly the same way on the bulletin board. Use formal photographs of the authors or the events mentioned if need be to give a personal touch. Make

(Continued on page 33)



Coal and Ashes Handling Simplified

You can make the work of delivering coal to your boilers and disposing of the ashes one of the easiest tasks in your power plant, and at the same time reduce the expense to a minimum.

Handle them with Webster Conveyors, and combine the advantages which mechanical handling affords with the further advantages accruing through the general serviceability and low cost of operation and maintenance of Webster equipment.

We make all types of equipment for coal and ashes handling from the highly perfected Perkins Pivoted Bucket Carrier to the simplest flight or belt conveyor. Ask for one of our engineers to look over your present conveying methods.

THE WEBSTER MFG. COMPANY

4500-4560 CORTLAND ST., CHICAGO

Factories-Tiffin, O. *and* Chicago – Sales Offices *in* Principal Cities

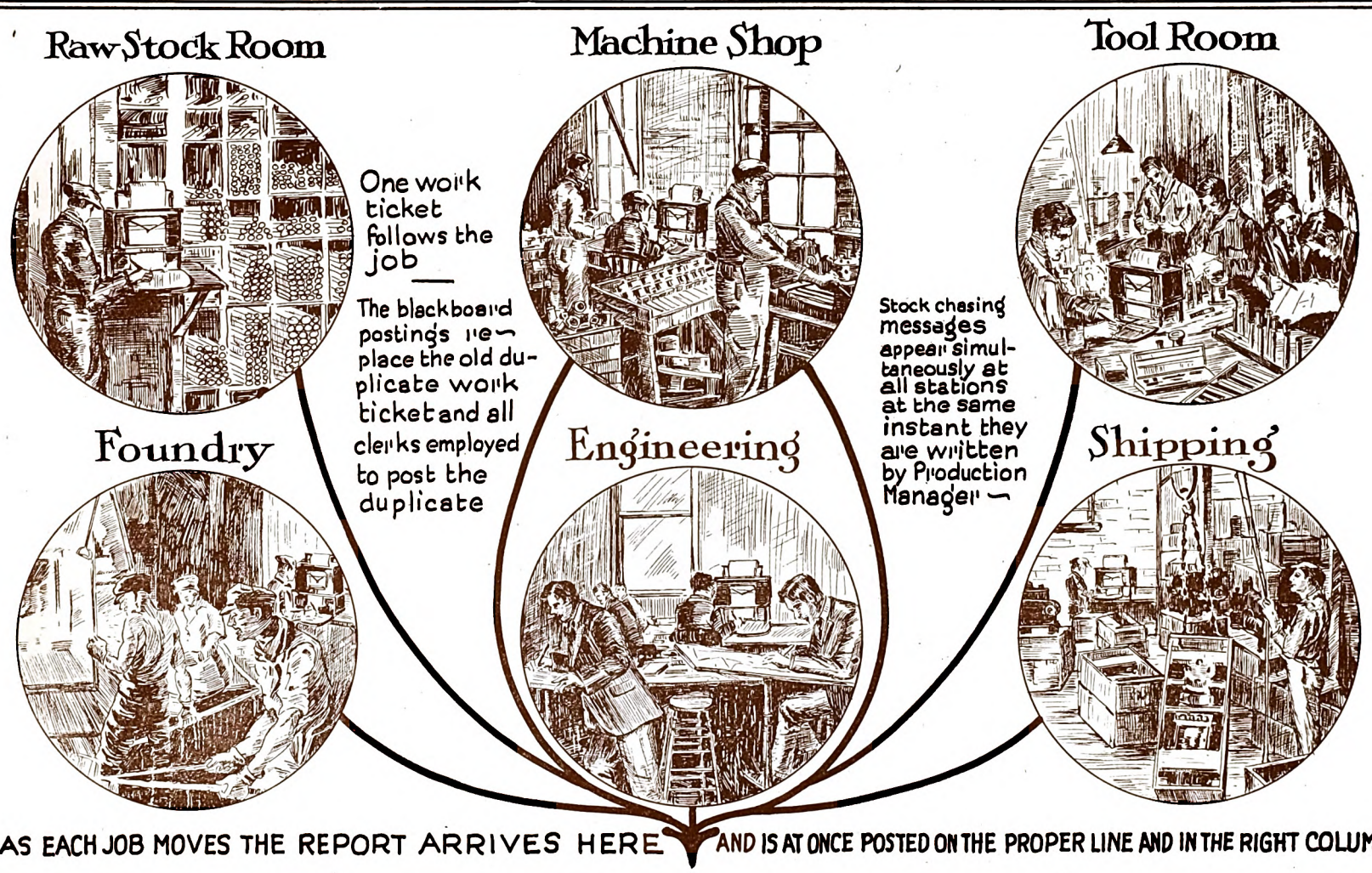
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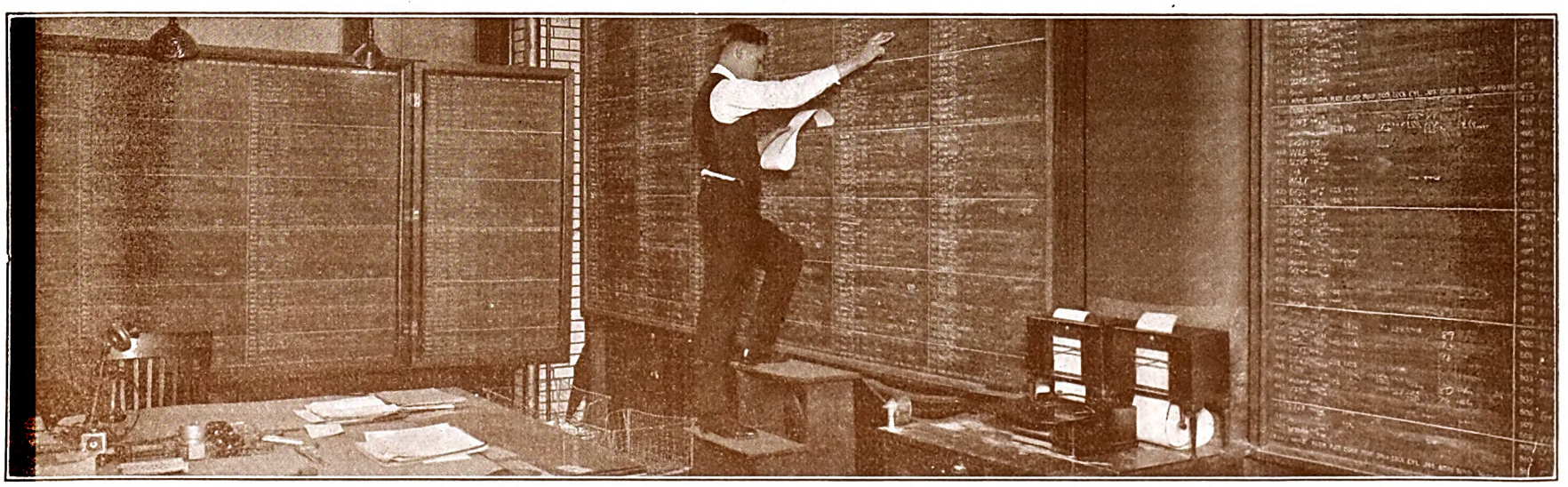
POST JOB PROGRESS REPORTS

LIKE THE BROKER POSTS "QUOTATIONS"! HOUSE MAIL IS TOO SLOW—STOCK CHASERS TOO COSTLY

TWO MESSENGERS COST MORE THAN THIS

TELAUTOGRAPH·SYSTEM





— PRODUCTION MANAGER'S OFFICE —

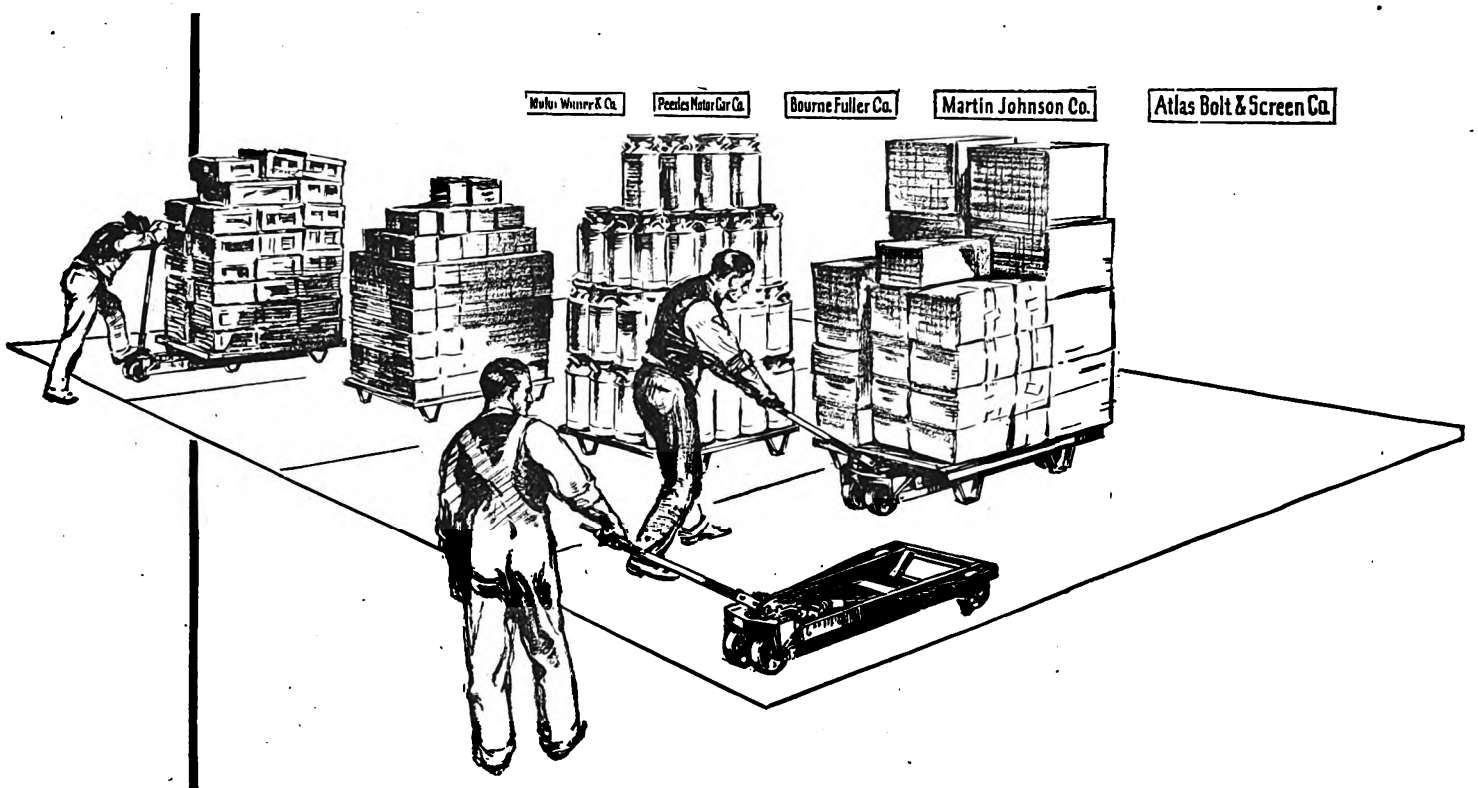
Write for our Booklet—No Obligation

TELAUTOGRAPH CORPORATION

General Offices and Factory—448 West 37th St., New York

Branches in 30 Cities — *Service in 105 Cities*

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Orange Ave. Terminal has cut heavy freight handling costs *in half* with Stuebings

There is a Stuebing Lift Truck in each section of the Orange Avenue Terminal (N. Y. Central R. R.). While awaiting call, loads of inbound freight are *kept piled on lift truck platforms*, conserving valuable storage space. Often, these platforms sustain loads of many tons!

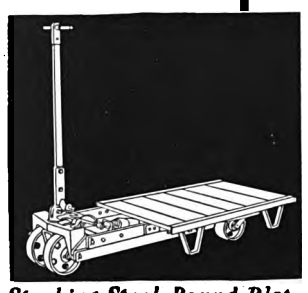
When call is made by consignee's trucker, it's an easy matter for *one man*, with the Stuebing, to pick up this *loaded platform* with one quick motion, and move it across the floor to the waiting truck.

It is done in almost the time it takes to tell it. One entire handling of all inbound freight is eliminated.

Time, labor and storage savings effected by the use of Stuebing Lift Trucks (operated with the trailer-train method of house distribution), *have cut in half the cost of handling this heavy freight.*

This is but one instance of many such savings. Ford Motor Co., W. F. Hall Printing Co., Western Electric Co., Globe Soap Co., and hundreds of like concerns in every field use Stuebing Lift Trucks because they pay for themselves over and over in the savings their use makes possible.

If you are not using Stuebings, a Stuebing representative can very probably show you a way to greater interior hauling savings than you ever believed possible. Write today.



Stuebing Steel-Bound Platforms match the Stuebing Lift Truck in strength of build and adaptability of service. They won't wear down or wabble

The Stuebing Truck Company
Cincinnati, Ohio Montreal, Que.

StueBing
LIFT TRUCK SYSTEMS

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(*Continued from page 30*)

every printed word live and speak in the spirit of the personal talk. Use "selling punch and pep." No manager would expect, for example, mere "Safety First" placards and stencilled signs to instill the habit of forethought and careful conduct in accident prevention any more than he would expect his representatives' business cards or the company letterheads to sell the factory output.

Here is a superb opportunity for the executive who has the real human touch, who understands the psychology of labor, who has studied the philosophy of modern industrial relations, who is sincere in his desire to "get next" to his people, who is imbued with a sense of his responsibility as an employer, who knows the mental and spiritual need of workers, who properly appraises "man-building" as a basis for organization, who correctly estimates the potency of goodwill as an element of industrial efficiency. Make the bulletin board a mirror that will reflect the sunlight of understanding into the darkest corners of shop ignorance and hostility.

The advertising expert recognizes the extraordinary value of "preferred position." The pictorial supplements of our leading Sunday newspapers are the highest priced newspaper space in the world. They command from two to four times higher rates for their advertising space than are listed for "run of paper." Exactly similar results, from the standpoint of the workers' voluntary attention at the bulletin board, is gained by good general-interest pictorial material as the central feature of the factory bulletin board. A central interest feature is very important to real success.

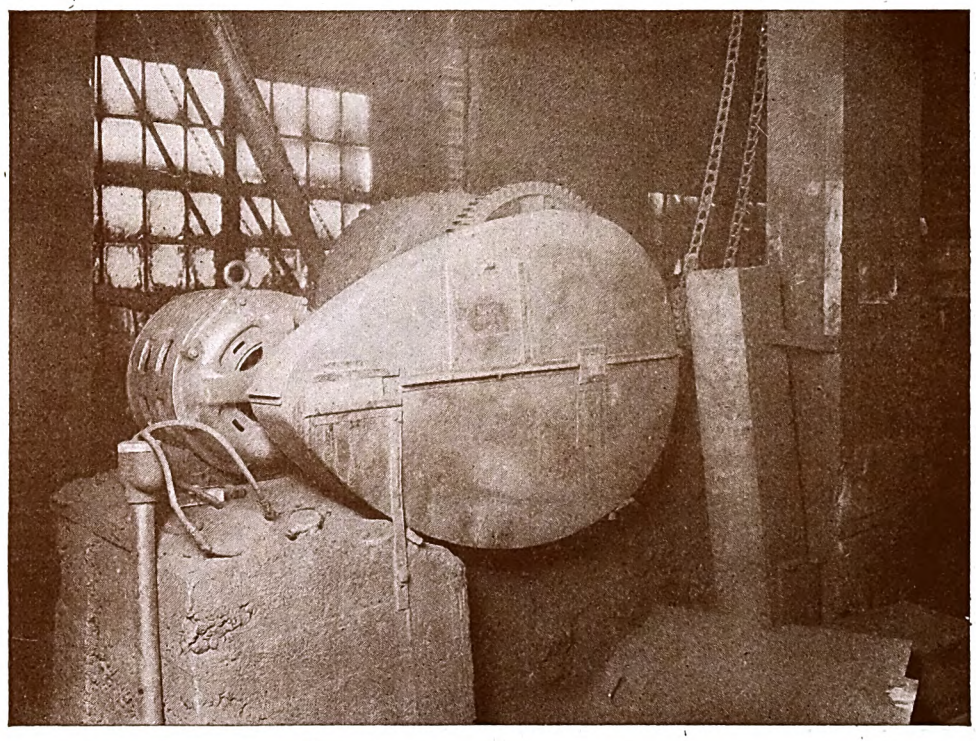
There is no possible form of "canned education"—whether it be syndicated house organ matter, pay envelope stuffers or bulletins—that effectively alone takes the place of straight management-to-man talks prepared and issued by each employer for his own people and dealing with their common problems. I believe sincerely in house organs. They offer a superb opportunity to develop esprit de corps, to teach accident prevention, to hold interest, to consolidate shop knowledge and opinion, and afford the workers themselves through their own contributions, a much appreciated chance for self-expression. The merits of the house organ, if edited with skill, are too well recognized to require an advocate. The sole criticism against the house organ is the tendency of many employers to place too much reliance upon such once-a-month publications and to expect altogether too much from them.

Most emphatically the house organ should be supplemented by a comprehensive system of daily bulletins of plant news. The simplicity and economy of the bulletin board method is self-evident. While the once-a-month house organ is necessarily an *incident*, the newsy bulletin board can be made an invaluable *influence*. Clearly influences are much more potent than incidents.

The bulletin board should be treated in the broad-minded spirit as previously recommended. The matter should

MORSE SILENT CHAIN DRIVES

THE MORSE "ROCKER JOINT"



Cut Transmission Losses
on Pulverizing and Grinding Equipment

Morse Drives are used on the following Pulverizing Equipment:—

Combustion Engineering Corp.
Fuller-Lehigh Co.
Kennedy Van Saun Manufacturing & Engineering Corp.
Locomotive Pulverized Fuel Equipment Co.
Allis-Chalmers Mfg. Co.
Chalmers-Williams Co.
Hardinge Conical Mill Co.

"Transmission of full power.....consequent increase in production," writes the Smith Facing Company, Cleveland, concerning a MORSE SILENT CHAIN DRIVE used to transmit power to Hardinge Conical Mill.

This Company further adds:

"This installation, which is transmitting 25 HP on a direct drive on but 3½ foot centers, not only eliminated a counter shaft drive requiring 60 feet of 10 inch heavy double leather belting, pulleys, countershaft, and hangers, but saved us valuable space as well. Further, our slippage difficulties have been overcome.

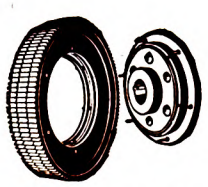
"Our satisfaction with the Morse Chain Drive is attested by the order you now have for the 75 HP drive for our Smith Tube Mill."

MORSE SILENT CHAIN DRIVES are the answer to EFFICIENT POWER TRANSMISSION.

MORSE CHAIN CO. - - ITHACA, N. Y.

Address Nearest Office

ATLANTA, GA...Candler Bldg., Earl F. Scott & Co.
BALTIMORE, MD.....1402 Lexington Avenue
BOSTON, MASS.....141 Milk St.
CHARLOTTE, N. C.....404 Commercial Bank Bldg.
CHICAGO, ILL.....Merchants L. & T. Bldg.
CLEVELAND, OHIO.....Engineers Bldg.
DETROIT, MICH.....7601 Central Avenue
KANSAS CITY, MO. Finance Bldg., Morse Eng'rg. Co.
MINNEAPOLIS, MINN., So. 3rd St., Strong-Scott Mfg. Co.
MONTREAL, St. Nicholas Bldg., Jones & Glasco, Reg'd
NEW YORK CITY.....30 Church St.
PHILADELPHIA, PA.....Franklin Trust Bldg.
PITTSBURGH, PA.....Westinghouse Bldg.
SAN FRANCISCO, CAL.....Monadnock Bldg.
ST. LOUIS, MO..Chemical Bldg., Morse Eng'rg Co.
TORONTO, Bank of Hamilton Bldg., Jones & Glasco, Reg'd
WINNIPEG, MAN., Dufferin St., Strong-Scott Mfg. Co.



Shear Spin Sprocket



Spring Sprocket

"Morse" Is the Guarantee Always Behind the Efficiency, Durability and Service

Digitized by Google



The beginning of furnace economy

Above is shown a front door arch partly built up, howing how chunks of Plibrico are pounded into place.

WHEN you have opened your first container of Plibrico Furnace Lining—then and not until then—you have started on the direct road to economical furnace operation.

PLIBRICO JOINTLESS FURNACE LINING

is a plastic lining that is installed with mallet and trowel. When baked it forms a jointless lining that is airtight, gastight, resistant to temperatures to 3,100 deg., and that outlasts ordinary fire-brick linings two to four times. Because of its putty-like form, Plibrico is ideal for baffles, arches and other special shapes.

Warehouse stocks in 52 principal cities—see 'phone book.

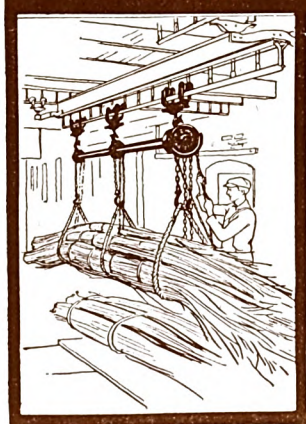
Plibrico is delivered only in steel containers of distinctive appearance as shown above and below.

This 50-page book **FREE**



JOINTLESS FIRE BRICK CO.
1154 Clay St. Chicago, Ill.

WRIGHT HOIST



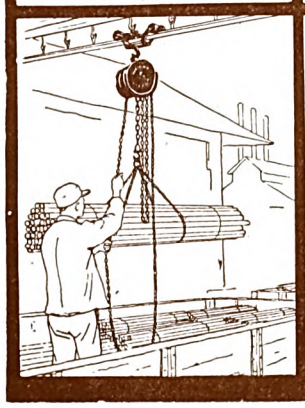
ARE you conserving Time—Energy and Costs in your Hoisting Operations?

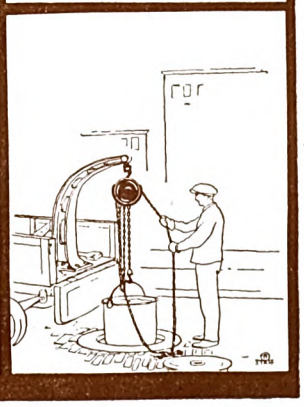
Wright Hoists are built to accomplish these results.

May we tell you how ruggedly they are built?

What's your name and address?

WRIGHT MANUFACTURING COMPANY
LISBON, OHIO





follow many lines and be free from monotony, considered purely in the light of an advertising or publicity problem.

It would not be difficult to list a hundred and fifty topics for an executive bulletin board talk every other day. There is, however, just one answer that can best be given to the topic question of what should be told to workers: Tell the workers all they ought to know to keep them interested, loyal, understanding, sympathetic, intelligent, contented coöperators and partners in your business enterprize. They especially want to know whether those profits are reasonable and commensurate with the business risk or whether they're 1,000% or 2,000% as so many agitators say. They want to know more about the raw material and the finished product. They want to know that the world finds worthy the children of their handicraft and skill; almost every human being thrives on and is energized by wise commendation. They want to know about big orders; about your competitors; about future products and markets. They want to know which department has done best or saved most or wasted least. They want to see some evidence of the employers' confidence in their judgment and skill and initiative. They want to see letters of commendation from customers. They want to understand a hundred whys and wherefores of business. They want to know the truth about national and international events which affect their factory's prosperity and something about the laws of economics and wages and living costs. The photostat offers a splendid method of presenting such matters in large display form.

The man who doesn't know how deeply all men long for such information and how square most men are in their hearts, and how much better most men work when they do understand, is tragically blind to the best impulses and instincts of human nature.

There are few workmen in the country who haven't been reached by the colossal propaganda of class hatred, malicious distorted arguments, economic fallacies and fanatical representations. There are relatively few workmen who have ever heard these misrepresentations contradicted. They have accepted what self confident and apparently well informed agitators fluently declare to be true and swallow it whole. When men are literally starved for facts it's no wonder they will swallow whole almost any fallacy presented as a fact.

There is just one known way to beat the agitator and that is at his own aggressive game. There's a perpetual active seller's market for discontent and unrest. There's only a potential buyer's market for Truth and Duty which calls for salesmanship and advertising. Let him who questions this contemplate that a few scant Americans go to church once a week while over 15,000,000 go to the movies every day!

The hope of this paper has been to outline the tremendous potentialities of the bulletin board for safety, for education, for coöperation and for good will. The bulletin board is the least expensive of all known methods of daily contact between management and employees. It is a direct and unfailing contact. No waste circulation—every reader a vitally important "prospect."

The success of bulletin board publicity is predicated upon its daily interest—reaching as nearly as possible every employee every day. That demands plenty of bulletin boards rightfully placed at strategic points. In large plants one bulletin to two hundred and fifty employees is generally a satisfactory provision. In many plants one bulletin must be provided for every 75 or 100, perhaps less. Remember this is fundamentally an advertising campaign and follow the rules that make advertising pull. The utmost cost of bulletin board publicity is but a microscopic fraction of the payroll—an almost immeasurable fraction of the cost of accidents, misunderstandings, ill will, labor turnover, spoilage, breakage, absenteeism and indifference. The employer freely spends thousands a year for the maintenance of buildings and machinery. Who can estimate how profitably he can spend

(*Continued on page 36*)

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Photographic Record Paper

For COPYING MACHINES

Back to Pre-war Prices

THE RECTIGRAPH COMPANY manufactures its own photographic copying machines and coats its own photographic paper, the entire plant being devoted exclusively to this line. Due to a lowering of the prices of some materials and economies effected in our new plant, we are enabled to announce a reduction of 20% from the prices prevailing on photo-copying paper for some time past.

Revised Prices on Rectigraph Paper

ROLLS 350-FT. LENGTH

8½-inch width .	$10.68
9½ " " . . .	11.93
11½ " " . . .	14:00
12¼ " " . . .	15.45
13 " " . . .	16.00
14 " " . . .	17 59
15 " " . . .	18.84
18 " " . . .	22 00
18¼ " " . . .	22.90
24¼ " " . . .	30.45

F. O. B. ROCHESTER, N. Y.

Rectigraph emulsions are coated upon a high grade 100% rag stock, producing excellent results with a durable base. Rectigraph paper is a contrasty bromide paper with excellent orthocromatic qualities, and will reproduce colors perfectly. All the speed consistent with good quality.

The RECTIGRAPH COMPANY has always regarded acceptance of an order as a pledge that it would be filled at the earliest possible date. The output of our plant belongs to our customers with orders on our books. This policy compelled us, during the past few years, to decline much desirable business which would have been highly appreciated, but this could not be considered without prejudice to previous connections. Improved facilities in our new plant enable us to increase production and quality and to decrease manufacturing costs. ***Our Customers will benefit.***

It may be to your interest to become acquainted with Rectigraph paper. We would be glad to receive your order for a sample roll, spooled to fit your photographic apparatus. You can then judge of its merits.

Rectigraph Company

(*An Independent Corporation*)

ROCHESTER, N. Y.

INFINITE VARIATION OF SPEED QUICKLY OBTAINED

"The Reeves" VARIABLE SPEED TRANSMISSION

——REGULATES——

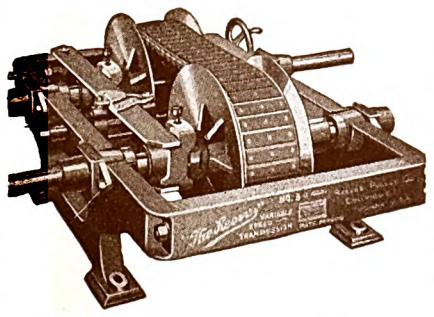
the speed of any machine or conveyor and enables the operator to get

FAST SPEED
MEDIUM SPEED
SLOW SPEED or
ANY IN-BETWEEN SPEED

desired even to a fraction of a revolution.

"The Reeves" Transmission is installed between the source of power—motor, line shaft or engine, and the machine to be regulated.

Any one speed may be maintained indefinitely or the speeds may be changed as often as necessary. It is possible to get a variation as low as 2 to 1 or as high as 16 to 1.



Put your variable speed problems up to us. Write for new 52-page catalog L.-44

REEVES PULLEY CO., COLUMBUS, INDIANA.

HALLOWELL

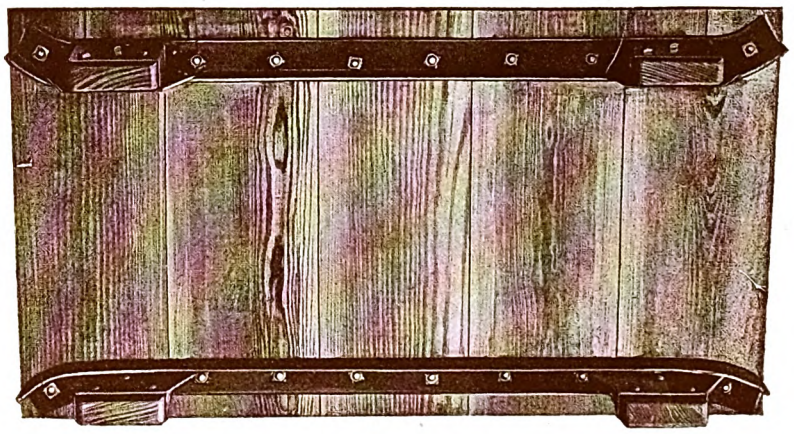
STEEL LIFT TRUCK PLATFORMS



Save Renewals and Repairs on Lift Truck Platforms BY USING THE "HALLOWELL"

From time to time the all wooden construction must be repaired, and finally complete replacement is necessary, therefore, the initial investment is only a small part of the ultimate cost.

The robust design of the "Hallowell"—heavy steel angles and leg blocks being securely joined by hydraulically driven rivets—renders it practically indestructible and, therefore, a very profitable investment.



Ends of runners are flared, as shown by above illustration, an exclusive "Hallowell" feature, which greatly simplifies entering the truck.

The value of this feature is soon realized by the workman after platform is put into service.

STANDARD PRESSED STEEL CO., JENKINTOWN, PA.

(*The "Pioneer" Steel Hanger People*)

INVESTIGATE

STANDARD PRESSED STEEL COMPANY, JENKINTOWN, PA.
Gentlemen: Kindly send me full details and prices of "Hallowell" Steel Reinforced Platforms.

Name .....

Company .....

Address .....

Truck used .....

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(*Continued from page 34*)

on all means for the maintenance of MEN?

The usual bulletin board, whether on safety alone or with general posters, is not often read by over 15% or 20% of the men—and by them not every day. 85% waste circulation! That's bad advertising—wasteful, extravagent, sterile advertising. A bulletin board that is an ineffective advertising medium is expensive at any price.

An efficient bulletin system that reaches the great majority of workers every day keeps them interested and gives them the information they want is, in effect, a daily plant newspaper. It may be confidently expected to pay dividends of at least $100 on every dollar expended.

This bulletin matter is too important to be left to a cheap clerk or a mediocre subordinate. It's a chance for a top-notcher with real sales-advertising vision—a big opportunity for a big-calibre, brainy man to make his personality permeate the very life, thought and spirit of a mass of industrial workers. The expected results are in exact proportion to the publicity skill and man-managing ability of the man to whom this big chance is entrusted.

The manufacturer who has not "sold himself" or been "sold" on the worthwhileness of safety and health publicity, on promoting good will, loyalty, better understanding and closer personal touch with his employees, will do well to devote earnest thought to the foregoing suggestions. He should turn his thoughts inward upon his business, his production, his turnover, his accidents and the efficiency and loyalty of his organization and strive to see wherein they might be improved by the information and education of his workers.

For photographs in this issue, not otherwise credited, we are indebted to the courtesy of the following:

MOVING MOUNTAINS WITHOUT THE SHOVEL GANG

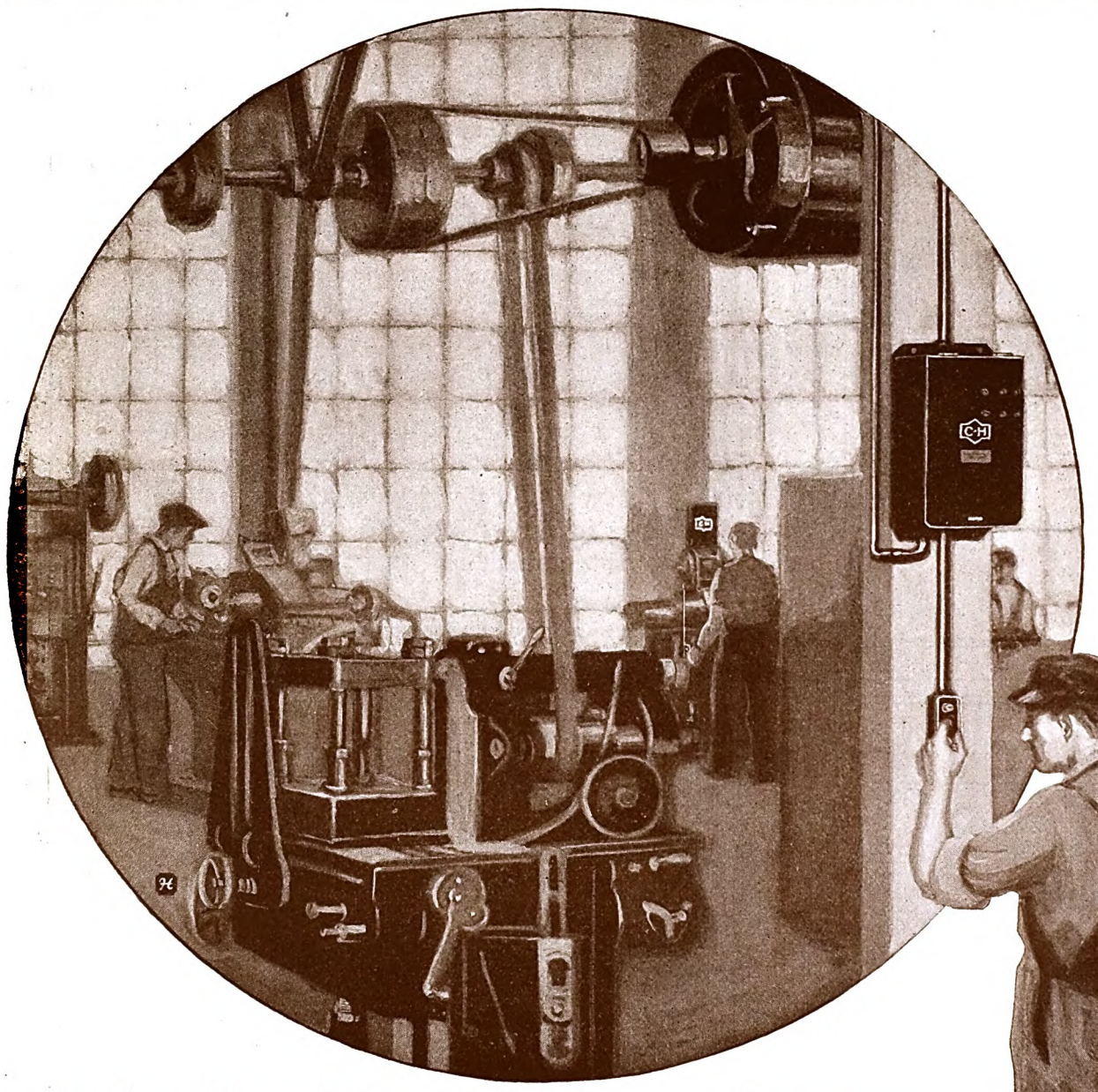
Barber-Green Company.
Chain Belt Company.
Dow Co., Inc.
Gifford-Wood Company.
Lakeside Bridge & Steel Company.
Robins Conveying Belt Company.
Webster Manufacturing Company.

PAINTING THE FACTORY

The Sherwin-Williams Co.
National Lead Co.
Protexol Corporation
The Hockaday Company.
Ingersoll-Rand Co.
Eclipse Air Brush Co.
Paasche Air Brush Co.
Spray Engineering Co.
The De Vilbiss Company.

THE LATEST ANSWER TO HIGH FUEL COSTS

Fuller-Lehigh Co.
Grindle Fuel Equipment Co.
Quigley Fuel Systems, Inc.
Combustion Engineering Corp.
The Raymond Bros. Co.
Bonnot Co.
Pennsylvania Crusher Co.





Reduce Your Motor Maintenance Expense

Prevent Production Delays

Today when every electric motor is needed to keep the wheels of production turning, it is important to prevent delays, motor burnouts and fuse troubles.

The C-H 9604 Automatic Starter for use with small alternating current motors has a number of advantageous features, which help to reduce maintenance expense.

The unique C-H Overload Relays are used in place of fuses—and thus the time lost, the trouble and expense occasioned by the blowing and replacing of fuses are saved.

They keep the motors on the job by preventing overheating and burning out of windings; they allow the necessary starting currents to flow, but at all times guard against overheating.

Attendants need spend no time or effort, and *safety* is provided to motor and men.

THE CUTLER-HAMMER MFG. CO.
Motor Control Department
Works: MILWAUKEE *and* NEW YORK
Offices and Agents in Principal Cities
Northern Electric Co., Ltd., Canada

For the control of pumping equipment, float switches or pressure regulated switches may replace the push button control stations so that pumping operations are automatically controlled according to water levels or pressures.

C-H CUTLER-HAMMER **AUTOMATIC STARTERS**
BULLETIN 9604 WITH MERCURY OVERLOAD RELAYS

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Jack in Office

By P. B. McDonald

IN the United States there has always been considerable grumbling at the officiousness and rude manners of minor officials intrusted with a little brief authority. Such employees as hotel clerks, office boys, foremen, small bureaucrats, committee sitters, assistants and deputies of various kinds, and even honorable secretaries, are likely to assume the air of a captain of industry or an ante-bellum Kaiser. Patient American citizens too often stand in line and tolerate petty tyranny from some conceited blockhead whose proper place is driving a truck or swinging a sledge-hammer. As a rule, the pettier the job the more officious is the manner of the incumbent; the man higher up is likely to be human and courteous. An English visitor to America recently expressed his amazement at the courtesy and lack of pomp of our general managers and corporation presidents, while expressing surprise at the rudeness of the outside clerks with whom he had to talk before meeting the higher officials.

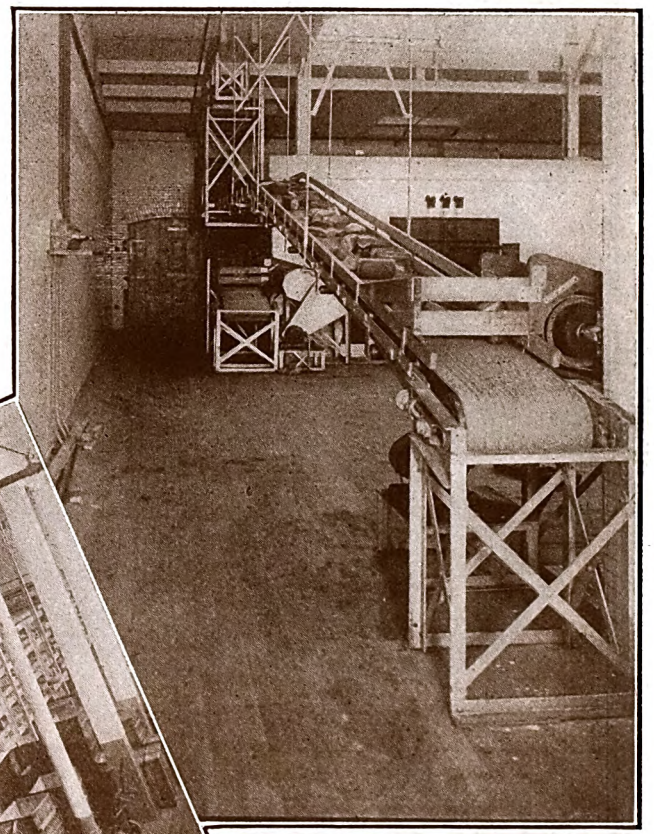
Yet the minor employee is not always a boor. Putting an ordinary small-minded man, full of Main Street ideas, into an office involving a little authority does not always have a bad effect upon him. On the contrary, it may turn a purposeless, shambling lout into a man who inspires respect and who takes pride in doing his work well—a sort of hero of labor. Look at the appearance of such a man out of work, or on strike, or even on his way to work, and then contrast it with the appearance of the same man doing work that appeals to him and that he can do well. The man out of work is likely to be an unlovely, ungainly figure with confused ideas and pathetic—even dangerous—possibilities; the same man at work—Jack in office—is a human being showing what he can do and that he is not averse to doing it. His self-respect impels him to exert himself and do as well as he can; he feels a certain satisfaction in seeing his assigned work done well. He wants to show overseers and onlookers that he has some ability and energy. One of the marvels of American industry is the ease with which an unknown man can appear in almost any industrial center, obtain a job with few questions asked, and become transformed from a colorless nonentity with no friends and little confidence into a useful, self-respecting worker—perhaps an official, a Jack in office. American employers deserve some credit for the sporting qualities that induce them to take an almost

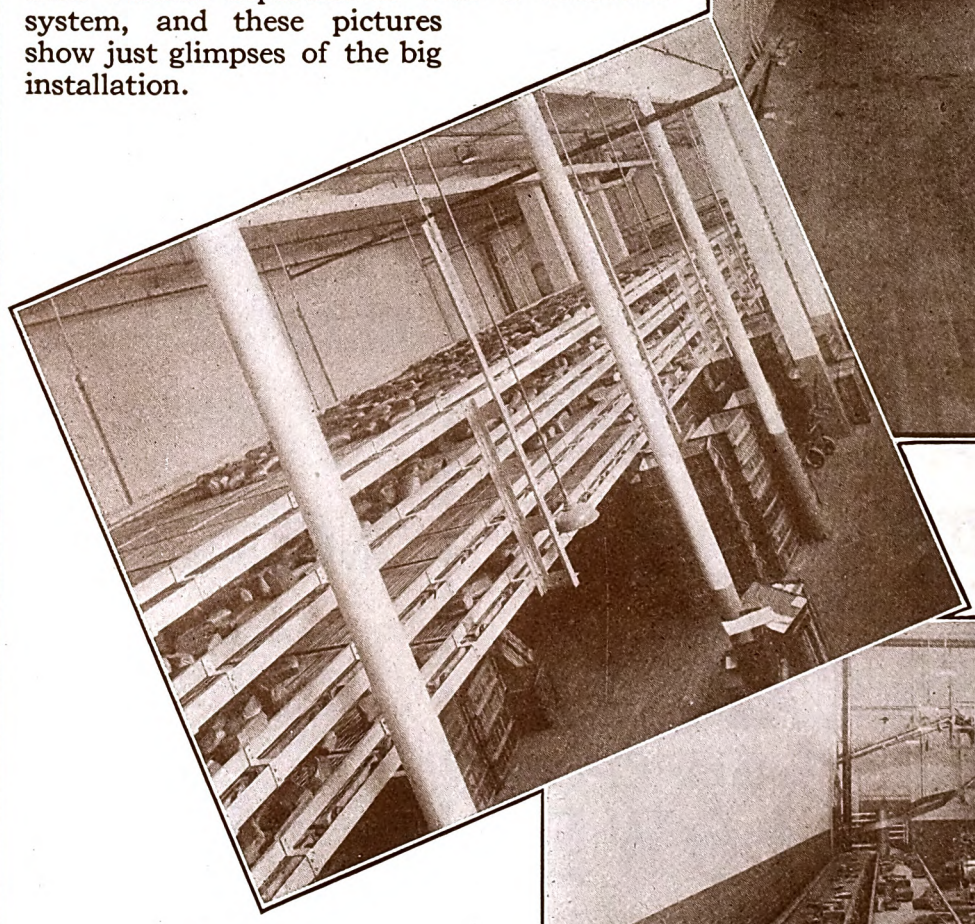
Speaking of Bread

affords an Opportunity to demonstrate the flexibility and versatility of

Mathews Gravity and Power Conveyers

The General Baking Co. have connected up their various departments with a Mathews system, and these pictures show just glimpses of the big installation.





Every manufacturer has problems involving the routing of raw materials and finished products.

There is a Mathews engineer near you ready to start work on a general handling system for your plant.



Come to
Package Handling Headquarters

with your conveying troubles.

Our engineering survey costs nothing. If we cannot offer an acceptable solution of your conveying problems.

Send for General Catalog

Mathews Gravity Carrier Co.

Branch Factories:
Port Hope, Ont.
London, England
161 Tenth Street,
Ellwood City, Pa.

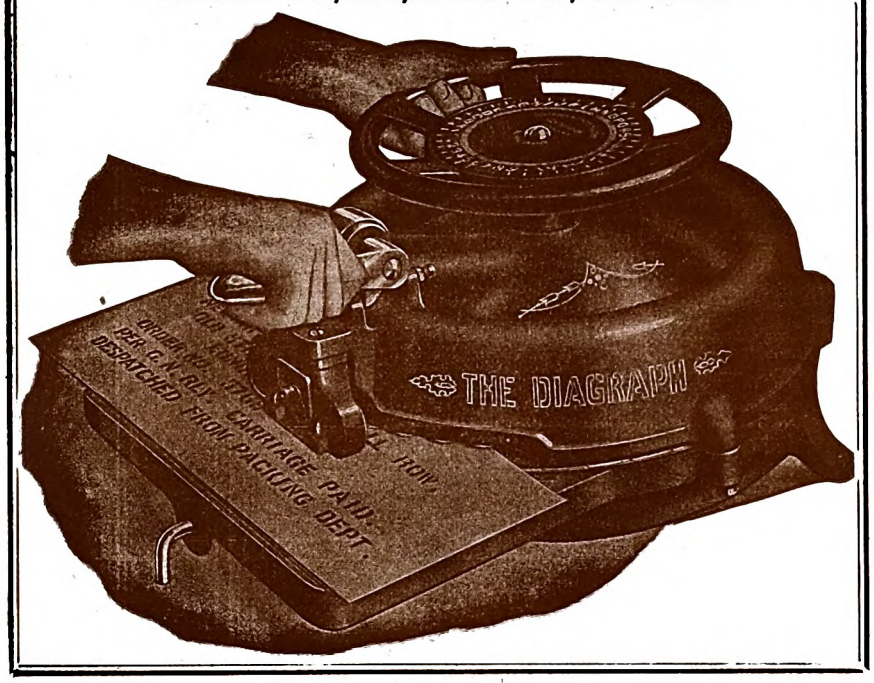
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DIAGRAPH
YOUR SHIPMENTS

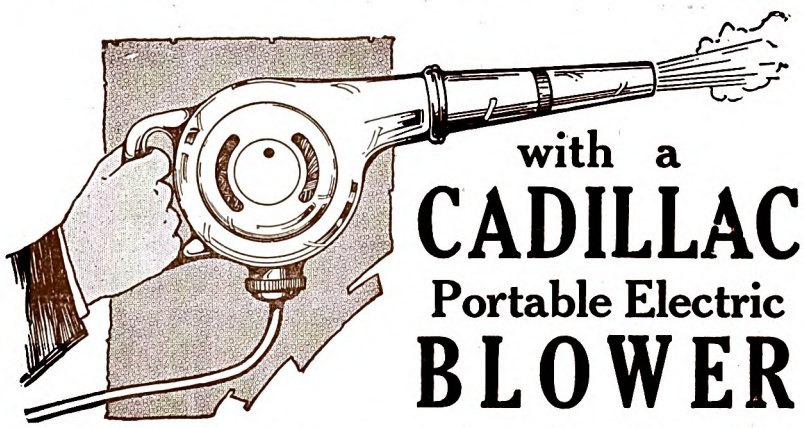
The Diagraph cuts legible address stencils for marking all packages, boxes, bags, cans crates, castings and similar material. Addresses do not blur, wash or rub off. Safer than tags. A practical insurance against lost and delayed shipments.

Try one free in your own shipping room—price complete with all supplies, only $110.00 delivered, in either housed or open models. Order one on trial—no obligation to buy—we pay all charges.

DIAGRAPH STENCIL MACHINE CORPORATION
1625 So. Kingshighway Blvd., St. Louis, Mo.
Branches in all principal cities. See phone books.



BLOW OUT THE DUST



with a
CADILLAC
Portable Electric
BLOWER

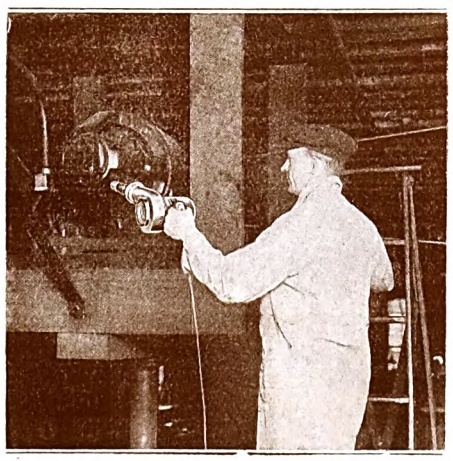
Blows dust out of motors, generators, machinery, line-shafting, stock-bins, shelves, etc. Lowers fire risk, eliminates needless waste of power in machinery by cutting down friction, and creates more healthful working conditions.

A complete unit in itself. Requires no expensive installation equipment; operates directly from electric light socket. Weighs only 6 pounds and may be carried and used anywhere. No condensation as with compressed air.

A practical, economical blower of *proved* value. In daily use by leaders in every industry.

Write for descriptive folder giving prices, testimonials by leading manufacturers, etc.

ClementsMfg.Co.
612 Fulton St.
Chicago



Cleaning small motors. No condensation to short circuit motor and no excessive pressure to injure windings or insulation.

unknown applicant, determine what he can do, and intrust him with responsible duties that make him feel really a man.

Jack in office is usually willing to work long and well to discharge the responsibilities put upon him. He has a code that impels him to serve faithfully when responsible work is expected of him. The implied trust in his character appeals to his pride, and he is more moved by pride than by extra pay—strange as it may seem. The same love of petty pomp and officiousness that occasionally makes him unbearable is another aspect of his pride in his work. Moreover, his surly self-importance is sometimes only nervousness and may be a shell covering real amiability and earnestness. One European visitor in America remarked at the "discourteous kindliness" that he found—a rough willingness to help coupled with a blustering lack of fine manners.

The minor official then has his good as well as his bad qualities. His nature and mentality have been suggested by H. L. Mencken in his excellent book "The American Language," where the author describes typical Americans of the skilled labor class. After referring to "Joseph Jacob's composite picture," Mencken adds some ideas of his own. Jacob's picture (American Magazine, March, 1907) is that of a mill hand in a small city in Indiana, with his five years of common schooling behind him, his diligent reading of newspapers, and his proud membership in the Order of Foresters and the Knights of the Maccabees. Mencken adds: "Go into any port of the country, North, East, South and West and you will find multitudes of his brothers, car conductors in Philadelphia, immigrants of the second generation in the East Side of New York, iron workers in the Pittsburgh region, corner grocers in St. Louis, holders of petty political jobs in Atlanta and New Orleans, small farmers in Kansas or Kentucky, house carpenters in Ohio, tinners and plumbers in Chicago—genuine Americans all, bawling patriots hot for the home team, marchers in parades, readers of yellow newspapers, fathers of families, sheep on election day." Such is Jack in office, a type of American industry.

Making Real Vacations Possible

(*Continued from page 17*)

after themselves when vacation time comes, but too often the woman worker is apt to feel that she must spend any time she has free helping about the home, making a dress for herself, attending to her mending, or doing other such chores. Another factor is the increased cost of vacations. Though the salary and wage scale has gone up, many people who ten years ago thought a week or two in the mountains or at the seashore a necessary event in their year's schedule, now find the rates so high that they stay at home and save rather than spend. Many employment managers testify to the same experience—women coming back to work from vacations, tired and fagged, without that quickened interest and renewed energy that rest, recuperation, and change are supposed to give.

It is to meet one or more of these problems—to make it natural and easy and inexpensive for workers to get the most out of their vacation time—that many employers have provided camps or farms in the country where their people may go at a minimum of expense and get the maximum of recuperation.

An example of a company vacation establishment at its best is Camp Sherwood, in Orange County, New York, near the village of Warwick. It is the camp of the New York Telephone Company, established three years ago. Camp Sherwood covers several hundred acres of woodland and fields, has mountains, its own brook and swimming pool, and though tucked away in the foothills of the Catskills it is within easy traveling distance of New York. Hundreds of

(*Continued on page 41*)

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Don't Let Hot Weather— Diminish His Efforts

HERE'S a real aid to production during the hot summer months.

Nothing like a cooling drink from one of these EBCO Bubblers placed at convenient points in your plant. They save unnecessary steps.

EBCO Bubblers are built solid, substantial and sanitary—no frills or excess parts. Their rugged construction means long life and economy.

EBCO Bubblers will make your plant an ideal place to work in and help in keeping *them* on the job.

Write for prices and illustrated catalogue.

The D. A. Ebinger Sanitary Mfg. Co.
W. Town St. & H. V. R. R.
Columbus Ohio

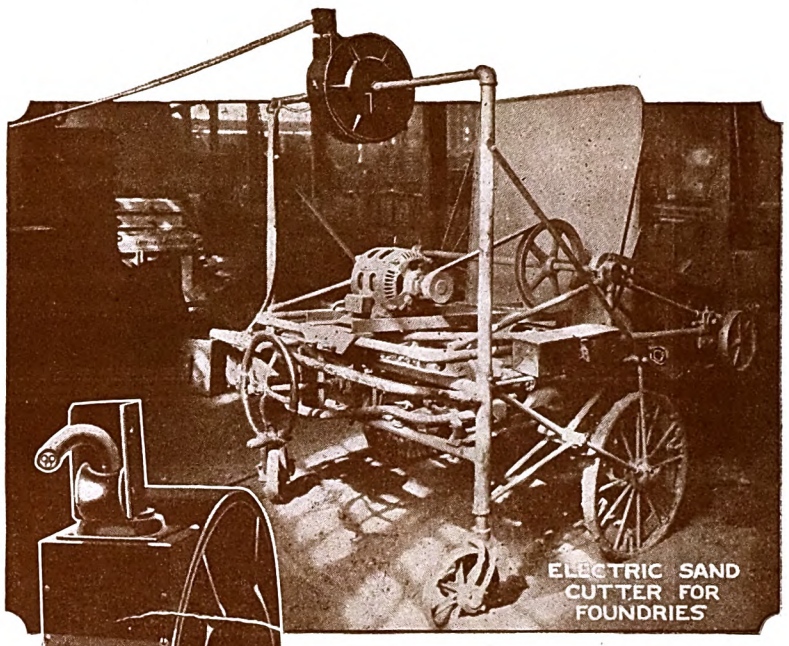
Minneapolis, Minn.
Hampshire Arms

New York City
101 Park Ave.

Detroit, Mich.
3942 Commonwealth Ave.

Charleston, S. C.
258 Congress St.

EBCO BUBBLERS



Cutting the Heavy Duty Cord Expense

Portable power machinery that requires varying lengths of cable can be made far more effective and less costly by the adaptation of the Heavy Duty Reelite. Cables dragged over floors and across machines, through oil and under the wheels of trucks quickly require repair—plus a loss of operating time for the machine itself.

Automatically Reeled Clean and Unkinked

The Reelite is entirely automatic—it holds and automatically retrieves cable of any number of conductors required—in lengths from 10 to 125 feet depending on the size of the cable. Made in small sizes for use as adjustable fixtures—or to be incorporated as automatic cord retriever for portable tools. The Heavy Duty Reelite is furnished with 1" male-threaded hubs and is readily adaptable for portable machines, cranes, dredges, mining machines, magnets, track welders, etc. If you are faced with a cord maintenance problem, our engineers' experience will be valuable.

APPLETON ELECTRIC COMPANY
1716 *Wellington Avenue*
CHICAGO

HEAVY DUTY
Reelite
REG. U.S. PAT. OFF.

Digitized by Google



Let JOHN BRIGHT show you how to get floors absolutely clean—at less cost—in less time

EVER have trouble cleaning dirty, oily floors? Most every one does. Maybe you have even had to scrape them. Ask your cleaning men. They are the fellows I would like to talk to, but they will probably never see this advertisement—unless you show it to them. That's a good idea, why don't you.

Ask them if they would not rather use a cleaner which removed *all* the grease and grime from the floors, walls, windows and wood work; one which would clean faster and better than the cleaner they are now using; one which would not burn their hands and clothing.

Ask your P. A. what he is paying for general cleaners. Then figure what you can save by using INTERNATIONAL CLEANSER No. 5 at 6½ cents per pound, using one ounce to the gallon of water. Don't lay your pencil down yet. Figure that you can cut your cleaning time down so low with my cleaner that you won't need so many men for general cleaning.

INTERNATIONAL CLEANSER No. 5 is entirely different from the ordinary run of cleaners. It is a scientifically prepared compound with unusual emulsifying as well as saponifying powers. It cleans like magic—leaves floors absolutely clean where ordinary cleaners, lyes and other solutions hardly touch the surface grease.

My usual guarantee holds good. Try INTERNATIONAL CLEANSER No. 5 at our expense until you prove to yourself that you want to buy it. I would like to hear from some of you folks who have almost given up hope of ever having *clean* floors.

P. S. Ask me about any cleaning problem. That sign up above means just what it says.

Internationally yours,
John Bright

International Products
I.C.C.
International Chemical Co.

INTERNATIONAL CHEMICAL CO.

PHILADELPHIA ~~~~~ PENNA.

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(*Continued from page 38*)

telephone girls go up there each summer, and for a nominal weekly fee—the camp is expected to be self-supporting—get all the advantages of country life combined with most of the modernities of summer-hotel conveniences. There are running water and shower baths. The girls live in rustic bungalows called "shacks" dotted about in the woods. But the shacks are wonderfully cozy affairs, equipped with such city things as closets, storm windows, window curtins, blankets that match, and all necessary furniture. It is true that the girls light their way to their shacks at night by kerosene lanterns—regular way-down-East stuff! But the main shack, where the eats are served in a rustic dining hall, and where there is a big fireplace to sit around, and easy chairs and roomy settles, books and magazines, a piano, a phonograph, and other take-it-easy equipment, has such luxuries as waxed floors and electric lights. Telephones? Oh, they are kept at the lowest possible minimum at Camp Sherwood. But all other conveniences are in abundance. There is even a stove with hot irons at the disposal of any young lady who wishes to do a bit of pressing.

Camp Sherwood shares the 420-acre estate which is its domain with an allied institution of the telephone company, Sherwood Hall. The latter is a large modern farmhouse used as a convalescents' home. It is for telephone girls who are just recovering from illness or who are run-down and in need of a rest. The Hall is kept open the year round and this fact is a big help to the Camp, for it means that cows are kept, and chickens, and a fifty-acre tract of the land is cultivated, thus insuring plenty of milk, butter, eggs, and vegetables.

Only a few miles from Camp Sherwood—so near that there are frequent visiting parties between the two camps—is Camp Isida where R. H. Macy & Company have a 102-acre farm as a vacation place for the girls employed in their New York department store. Camp Isida is in Sullivan county, New York, where the Catskill mountains begin, near the village of Burlingham. About 60 acres of the estate is wooded; the rest of it is cleared land and a ten-acre lake. The houses are on the shores of the lake—a Main House, which is camp headquarters; "Greenwich Village," a large dormitory with sleeping porches; and two smaller houses. The camp can accommodate 100 girls, and during the summer months it is generally full, overflowing at week-ends, and with waiting lists for possible vacancies.

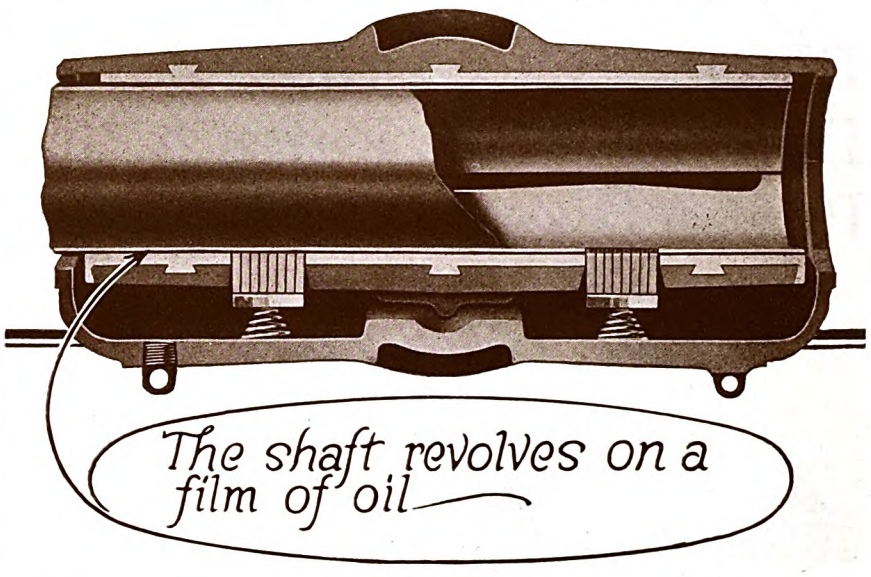
Camp activities here are systematically organized, though there is no compulsion about anything except the times for serving meals. There is boating on the lake and swimming, dancing, tennis, basket ball, hikes, pantomimes, picnicking, nature study-classes, and classes in first-aid. Every Friday night the camp members gather for a council around a huge camp fire, at which emblems are awarded for the week's winners in hikes and other competitive sports and activities. Fishing may be indulged in nearby streams. For those who simply wish to loaf hammocks are slung in the apple orchard.

While Camp Isida is owned and operated by the company, its rules and regulations are made and discipline enforced by a camp committee of thirty girls. This medium of self-government has been found to work remarkably well, and if any other company is considering the establishment of a vacation camp it would do well to consider this device. Somehow or other discipline seems to be better where the girls themselves, through their own elected committee, ordain the law and supervise its administration. Not only do the girls take more interest and responsibility, but there is a strong sense of proprietorship as a result of this self-government.

Camp Isida is exclusively for women. The Macy store also has a vacation place for its men near Bear Mountain, in the Palisades Interstate Park. This is Camp May-ga-lan-ka (Indian for Red Star), situated right in the heart of the Catskills-Hudson River country, eight miles from the River, more than 1,000 feet above sea-level, in the midst of world famous scenery. This camp is not owned by the store

(*Continued on page 43*)

Fill this bearing with oil every six months—no further attention required



The positive unfailing law of capillary attraction provides a constant, uniform and unbroken film of clean lubricant between the shaft and bearing lining—preventing bare contact of metals which invariably means excessive friction.

The action of the capillary oiler is non-agitating—dirt and grit settles to the bottom of the reservoir and stays there—it cannot reach the shaft.

The following illustrations show clearly the action of capillary attraction as it applies to the Dodge bearing.

The depreciation of Dodge capillary bearings is negligible—they will operate as efficiently and economically after twenty years' service under high speeds and heavy loads as when originally installed.

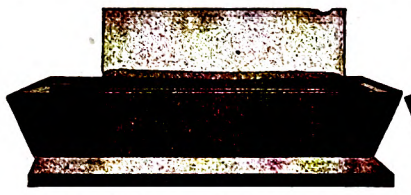


Fig. 1. Photograph illustrating capillary attraction between two glass plates standing parallel in oil. As shown, the oil has risen between the plates to a height above the surface of the oil in the tray proportionate to the distance between the plates.

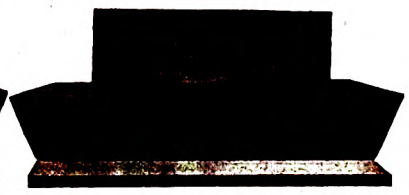


Fig. 2. Same plates as shown in Fig. 1 made to touch at their right hand ends only. Oil has risen to the tops of the plates at point of contact. These plates are in the same relative position as the surfaces of a Dodge Capillary Bearing.



Fig. 3. To represent the shaft in a capillary bearing, a strip of glass has been laid on top of the two plates. Note the increased rise of oil in its endeavor to cover the top plate. It has the same tendency to cling to the shaft in a bearing.



Fig. 4. A spoon supported one-eighth of an inch above the surface of the oil was depressed to touch the oil and was then allowed to spring back to its original position—the oil followed as shown. This same action takes place when the level of the oil gets below the bottom of a Dodge Capillary Bearing.

Specify Dodge capillary bearings for line and countershaft use—they are time tested and safe. Buy them from your local dealer.

DODGE

Power Transmission Machinery

DODGE MANUFACTURING CORPORATION

General Offices: Mishawaka, Indiana. Works: Mishawaka, Indiana, and Oneida, N.Y.

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Job Time
Machine Time
Payroll Figures
Efficiency Records
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All of these results are obtained without copying or transcribing a single figure. With the Calculagraph it isn't necessary to struggle with a long piece of tape, or a large card or sheet, picking out from a confusing mass of figures workmen's numbers, job numbers and times of starting and stopping, or wasting valuable time in mental calculations and copying before the desired result is obtained. Calculagraph records are complete and easy to classify—just shuffle the cards and add the figures shown on the face of each card. An adding machine may be employed for this purpose.

If you don't know the Calculagraph—the machine which records starting, stopping and elapsed time—write for our booklet "Elapsed Time Records."

CALCULAGRAPH COMPANY
34 Church St. **New York City**



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(*Continued from page 41*)

but is leased from the Interstate Park Commission, and consists of several sleeping cabins, a mess hall, and washhouse, all done in log-cabin style, nestling in the woods on the shore of Lake Tiorati. Camp life here is truly camp life, and persons whose vision of a vacation includes call-boys to answer pushbuttons, hot and cold running water, tennis courts, golf links, and the like, won't find what they want at Camp May-ga-lan-ka. Vacationing here means fishing and swimming, hiking, camp fires in the woods, and living pretty close to nature in a place where nature is at its best.

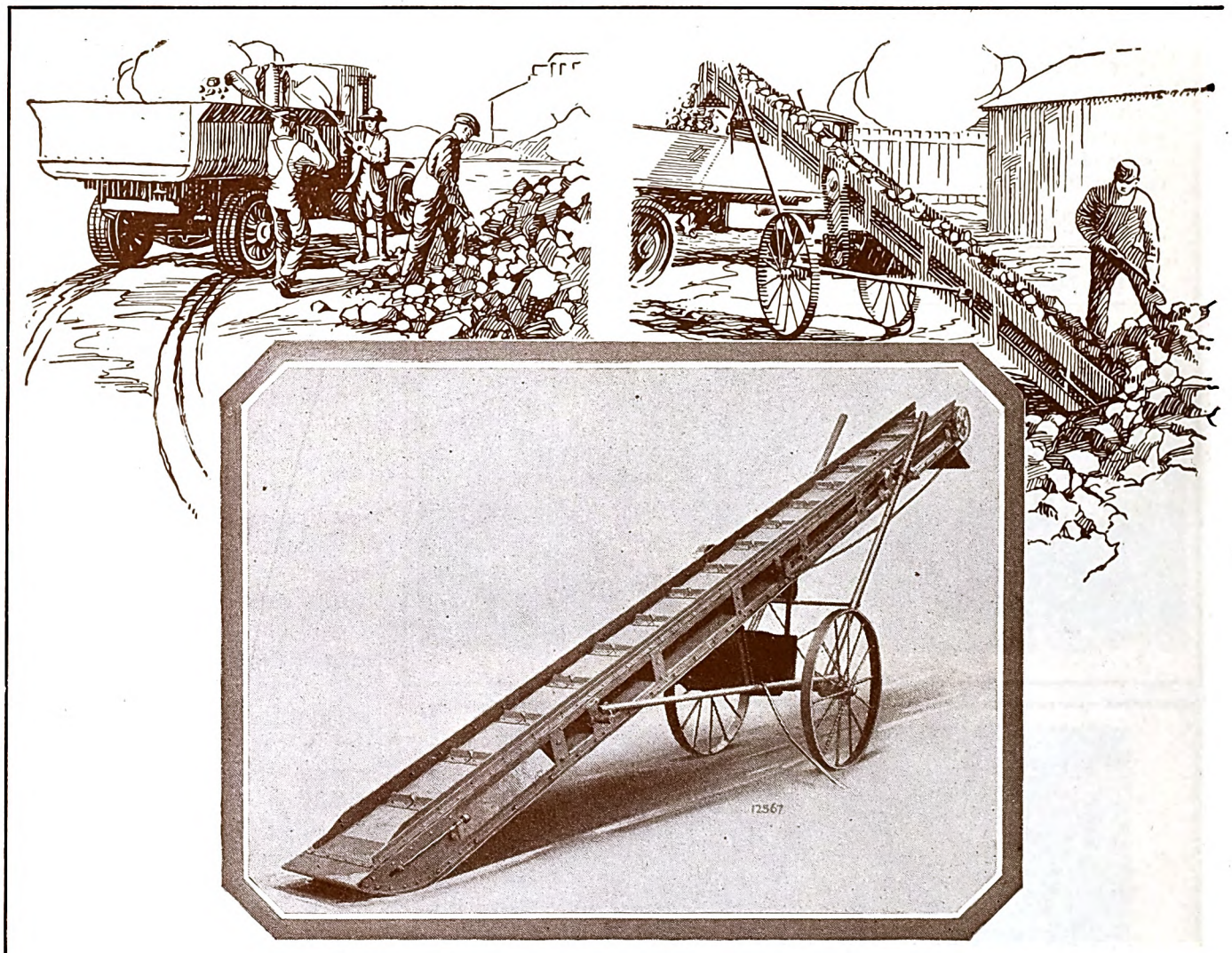
A missing feature at Camp May-ga-lan-ka is the kitchen. There is no cook, and no cooking done in the camp, other than the casual bacon broiling and fish frying around an occasional camp fire. Meals are supplied by the Interstate Park Commission (which serves a number of neighboring camps in the same way), are cooked at the Bear Mountain Inn, and brought each day by motor nine miles to camp. In spite of the long distance, the service is said to be quite satisfactory.

A more extensive and elaborate camp is that of Kaufman's, the Pittsburgh department store. It has an immense domain of 1,700 acres on a great natural plateau in western Pennsylvania more than 1,100 feet above sea level. The land is traversed by Bear Run, a famous fishing place for mountain brook trout, and one can follow this stream for five miles without leaving camp territory. The camp itself comprises a central club house and five cottages, the cottages being used mainly for family parties. There are also a dancing pavilion and several back-to-nature houses, the latter reserved for week-end parties. This camp has a capacity for 75 regular vacationists and 24 week-enders.

Among the pioneers in the vacation camp movement are the Chicago packing companies, Swift & Company and Armour & Company, both of which are large employers of women. The Armour camp is at Round Lake, a few miles out of Chicago, where the company has made full use of a beautiful setting, erected roomy comfortable buildings, provided all the conveniences of a summer resort, and yet kept the place a sheltered isolated retreat. Hundreds of girls and women employed in the packing plants and offices go here for one or two weeks each summer as guests of the company.

The Swift camp is at Fish Lake, which is really two lakes, and the camp is really three camps. There is one camp for women employed in the plant, and to it is assigned one of the lakes. Another camp, built on the shore of the second lake, is for women employed in the office. A short distance away is the third camp, for office boys, a comparatively recent addition. Each of the camps is equipped with substantial dormitories, with sleeping porches and recreational rooms, and there are diving piers, boats for rowing and fishing, tennis courts.

Both Armour and Swift have developed vacation camps in connection with some of their branch plants—but one



One Man Against Three

One man and a Jeffrey "Portable" can load a 5-ton truck in 10 minutes. Doing this work by hand takes 3 men 40 minutes. Figuring then the cost of labor at 40c per hour, the conveyor will load at a cost of 2c per ton against 16c per ton by hand, or an average saving of 14c on each ton loaded.

Rugged design, sturdy construction, ease of operation and economy of operation, fully qualify the Jeffrey Portable Belt Conveyor to completely meet, at low cost, the loading or unloading requirements of Industrial Plants, Contractors, Quarries, Retail Coal and Building Supply Yards, etc.

Send for a copy of Bulletin No. 369, which illustrates and describes the Jeffrey Portable Belt Conveyor in detail.

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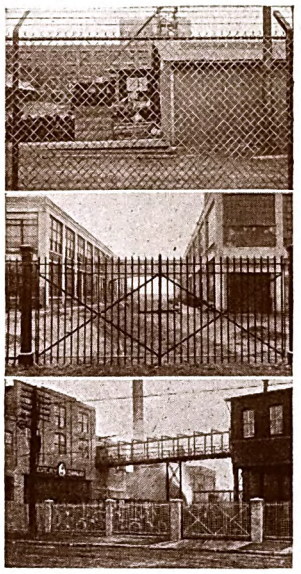
Cleveland, Ohio...828 Nat'l City Bank Bldg.
Denver, Colo.....1751 Wazee Street
St. Louis, Mo.....606 Pontiac Bldg.
Detroit, Mich.....455 Book Bldg.
Milwaukee, Wis.....M. & M. Bldg.
Boston, Mass.....141 Milk Street
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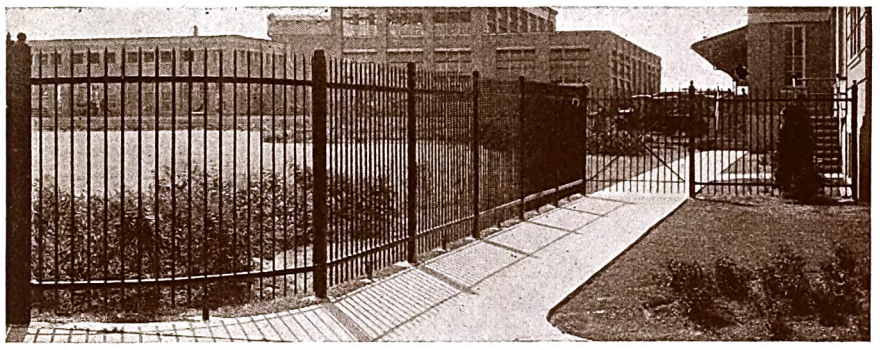


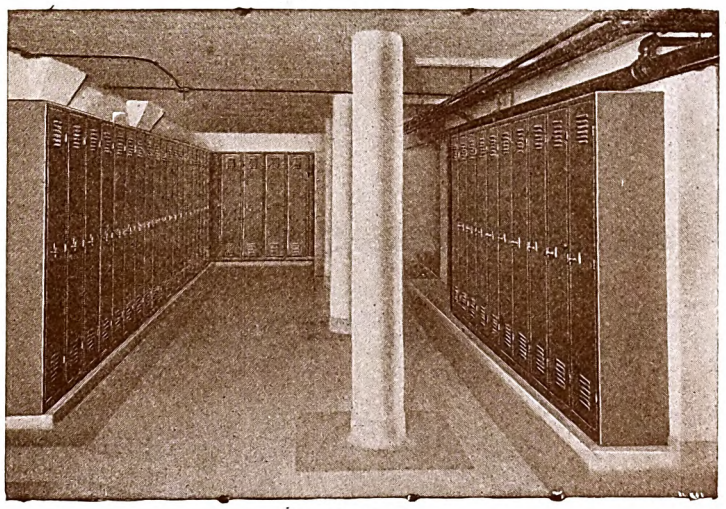
Even the original cost of Enterprise fencing is less than you imagine. And when you consider the advantages of its secure protection, the possibilities for expanding valuable outside storage space to your very property lines, in addition to the other opportunities for more efficient plant management, good fencing is a paying investment on which you "cash in" many times over.

Don't delay your needed fencing improvements, but write to-day for our catalog. Put your problem up to us —see a blue-print of the fencing installed and know the cost. Then decide.

Enterprise Iron Works

1110 E. 24th St. **Indianapolis, Ind.**





Installation in
Proctor & Gamble Plant, Cincinnati, Ohio.

THE good will of your organization is a very great, if intangible, asset. There is no better way to create this good will than by furnishing each man with a convenient, roomy Berloy Locker where he can keep his clothing and personal belongings safe from rodents, theft and dust.

While the outlay in money for an equipment of Berloy Lockers is comparatively small, the returns in good will and co-operation of employees are invaluable.

Our catalogue Y-50 will help you decide on types and sizes most suitable for your use. Write our nearest office for it today.

BERLOY STEEL LOCKERS

THE BERGER MANUFACTURING CO., CANTON, O.

Boston	Philadelphia	Ⓑ BERLOY	St. Louis	San Francisco
Chicago	Kansas City		Dallas	Los Angeles
New York	Minneapolis		Roanoke	Jacksonville

would have to go far to find so admirable a setting and so complete an installation as that of the camps which serve the Chicago plants and offices.

Somewhat different from the institutions described in the foregoing paragraph is the country house maintained by Guaranty Trust Company of New York at Patterson, a town in up-state New York. The primary purpose here was to provide a comfortable place in the country where employees of the company might go to rest and recuperate after an illness. But happily for many the Guaranty Country House is not exclusively a convalescents' home and illness is not a prerequisite for a visit there. Every summer, as well as in other seasons to a lesser degree, many of the workers in the big trust company and its branches go out to Patterson for one or two weeks' vacation.

The establishment at Patterson is a comfortable old farmhouse set in an estate of sixty acres. The house has been thoroughly modernized. There are orchards and meadows and oat fields, a trout brook, winding drives, broad acres lined with willows and maples, and the distant view of the Berkshires. The usual recreational facilities of country life are provided, but there is little of the "roughing it" of camp life here, the main thought being to afford the quiet restful surroundings and accommodations that one would get on a comfortable country estate.

Another New York bank undertook to provide a vacation place for its employees some years ago, with results not altogether successful. It secured a place on the Long Island shore, equipped the house, and opened it to employees at a nominal charge. Many took advantage of the house for week-end parties, but few seemed to care for it as a place for the regular summer vacation of two or three weeks. Investigation showed that most of the employees, when they went on a vacation, wanted to go somewhere new and somewhere farther away from home. The Long Island house was too familiar to them, and also too near the big city. Further investigation showed the bank management that only a relatively small number of employees were using the house for week-end outings. While it was filled almost every week-end during the summer, the group was composed of pretty much the same persons each time. Since the overhead expense of the place amounted to a tidy bit, which the rates charged did not cover, the bank finally decided to close the house. It was felt an unwise policy to maintain a place for the benefit of so small a proportion of the employees; and the house was finally disposed of.

There is a large business concern in New York quite famous for its personnel activities, which comprise many club and other welfare features. But this company has no vacation camp for its people. "We do about everything else for our employees," said the service manager here, "but vacation is one time when a fellow generally wants to be left to make his own plans. A company vacation camp would not appeal to our people at all; most of them want to get away from the usual crowd when they go for their annual rest and change."

The service manager of another institution took a different angle on this question. "Of course there are hundreds of our employees who make their own vacation plans without consulting the office, and who never use our camp. But there are hundreds of others who really do not know how to take a vacation. They are unaccustomed to country life; don't really know how to get the most out of the country. Atlantic City is many people's idea of a vacation. They go there, put up at some crowded hotel or boarding house, idle around on the board walk a few days, don't know what to do with themselves really, and come back home all tired out. They are only too willing to welcome advice on their next vacation, and far from objecting to a vacation with a group of their business colleagues, they welcome it, and dread the thought of being isolated among strangers. This is true of women workers, especially of those employed in department stores. For these workers, the vacation camp under company auspices is a great

(*Continued on page 46*)

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DRY ROT

quickly destroys the wooden core of Tin Clad Fire Doors, leaving only a shell to resist the knocks and bangs that most doors receive and to prevent a furious fire from spreading should the emergency arise. Superficial inspection does not reveal this condition but - -

WHEN DISCOVERED

extensive repairs and very often replacement of the entire equipment is necessary at a great expense.

TRADE MARK

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FIRE DOORS

are made of *steel - - galvanized and asbestos* welded and riveted to *heavy steel frames*

They Can't Rot

yet they *cost no more* than less durable equipment

Write today for illustrated catalogue

MERCHANT & EVANS CO.

Philadelphia, Pa.

Offices in Principal Cities

Just Suppose--

You had coming to you every month a big bunch of Pictured Progress such as you see in this copy of

INDUSTRY ILLUSTRATED

Wouldn't you give it a hearty welcome?

Wouldn't it put a dash and a sparkle into the daily grind you have always wanted—but which you have found hard to get?

And ***wouldn't*** it be worth to you many times what it costs?

This coupon is for YOU—use it NOW

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120 West 32nd Street, New York

SEND ME INDUSTRY ILLUSTRATED every month for a year. I shall remit when your bill comes—sometime within the next thirty days.

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ANNUAL SUBSCRIPTION $1

In Canada, $1.25; Foreign, $1.50

If You Are Interested in Cutting Cleaning Costs

Send for This Book

BY careful study of cleaning methods and requirements in factories, mills, shops, etc., we have perfected a line of brooms and brushes, each of which is built for a particular service. By using the CAPITAL Broom or Brush that meets your special needs, you can secure better, faster cleaning, at less labor cost. Moreover, specialized CAPITAL Brooms or Brushes will make a very considerable reduction in your purchase expense in this item of factory overhead. Countless tests have proved that they outwear two or three ordinary brooms or brushes.

Catalog 17 illustrates and describes the entire CAPITAL Line. Send for it today —and select the CAPITAL Brooms or Brushes that exactly fit your requirements.

INDIANAPOLIS BRUSH & BROOM MFG. CO.

I. W. LEMAUX, President

130 Brush Street Indianapolis, Ind.



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(*Continued from page 44*)

opportunity and service, which they appreciate."

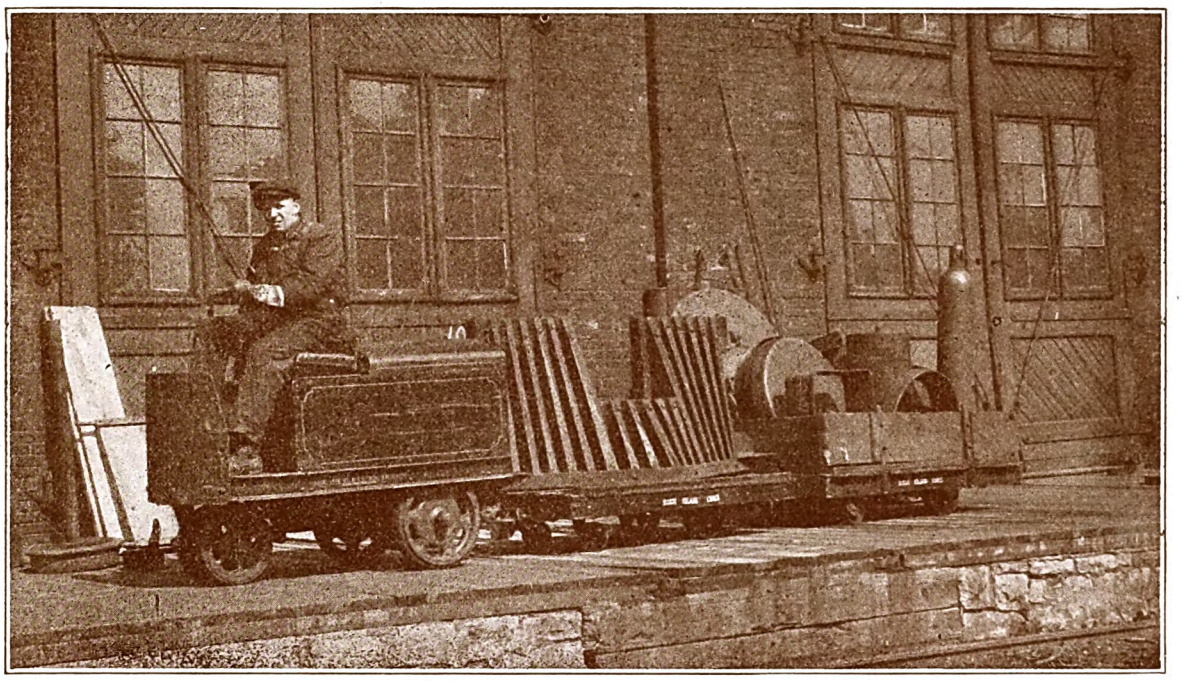
Another thing, pointed out by the service manager of a department store, is the great growth in popularity of outdoor life within recent times. It is only a matter of a few years that camps have had an attraction for the city working girl. The whole outdoor movement is new. Only twenty years ago large numbers of people were still rather suspicious of the open air, slept with closed windows, and lived in fear of a draft. We are different now, and the difference is reflected in our sports, our recreations, our vacation activities. Girls wear knickers and play ball quite as enthusiastically as they dance, and for these new accomplishments an outdoor setting is essential.

From the employer's standpoint there are other considerations involved in company vacation camps. The thing is an expense, for it is difficult to make the camp carry its overhead, even where rates are charged sufficient to meet the current expenses. For example, there is one company that has invested $120,000 in its vacation camp. Interest alone on the investment, figured at 6 per cent. amounts to $7,200 a year. Then, though the place is used only four months of the year, a caretaker has to be there all the year round, and his salary amounts to something. Besides, there are taxes, insurance, upkeep expenses of various kinds.

Some companies reckon the vacation camp as a regular service activity, and provide the vacation without expense to the employee, even going so far as to pay railroad fare to and from camp. This point of view is most prevalent among vacation camps for factory workers; though not all factory camps are free. Most concerns charge a regular weekly rate of board; in one camp it is as low as $5 a week; in another it ranges up to $15 a week. One company has a sliding scale of rates, the charge varying according to salary, though the board provided is the same for all.

Another problem is that of supervision and operation. A camp will not run itself, though as stated it is a good idea to ask the campers to assume some responsibility for self-government and leave with them the task of making and enforcing camp regulations. But a paid staff of several workers is required where the camp is of any size. Camp Sherwood, for example, last summer had a staff composed of 1 camp director, 6 recreational directors, 1 arts and crafts teacher, 1 dietitian, 1 nurse, 1 camp clerk, and 1 registration clerk—12 persons in all. And this of course does not include the help, both kitchen and house help and that employed in the garden. This camp is favored by its alliance with Sherwood Hall, the convalescents' home, for much of the farm help is attached to the Hall, though the camp shares the benefits.

Camp Isida, the R. H. Macy & Company vacation place at Burlingham, is fortunate in its supervision. The Camp Director here is a woman who was formerly dietitian in charge of the store's cafeteria in New York, so she was thoroughly imbued with the ideals of the



MERCURY TRACTOR AT ROCK ISLAND SHOPS SAVES $34.16 PER DAY

One Mercury Tractor with a few trailers has replaced a trucking gang of five men at the 47th Street Shops of the Rock Island Railroad, Chicago, Ill. Carefully kept cost records show that the tractor has cut trucking costs from 68c per ton to 8.6c per ton. In addition to maintaining a scheduled material movement between the various departments, the tractor finds time to push dolly loads of flues—to tow tenders to the track shops—and to peddle daily two tons of ice. This one tractor is actually saving $34.16 each day as shown by cost records

Savings equally as great are possible for other Railroad Shops. A Mercury representative will arrange an appointment at your convenience.



MERCURY MANUFACTURING COMPANY, CHICAGO, U. S. A.

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store before taking up the camp work. Her husband is a graduate of the Cornell school of agriculture, and is superintendent of the camp farm. They live there the year round, farm the cleared land, and make it yield something beyond summer vacations. There is a chicken yard in connection with this camp, and in winter the eggs are sold to employees of the store.

As to the future of vacation camps: With the development of winter outdoor sports, which have made such strides in recent years, vacation camps will be considered not only for summer vacations but for winter vacations as well, and for week-end outings all the year round. This will remove the objection of those who think it poor economy to maintain extensive properties for use only a few months of the year. One of the business women's lunch clubs in New York, which maintains a club house in the country, had to keep its country house open most of the winter of 1922-1923 to accommodate the week-end parties of girls.

Company physicians are especially strong for regulated vacation places where the outdoor life is made possible, and much encouragement to the movement may be expected from them. Some of the companies named in this article are already developing plans for the enlargement and further improvement of their camps. The inquiries they get from other companies who are looking into the question indicate an interest on the part of the inquirers which is more than idle curiosity.

Keeping the Fire Demon Out of Your Coal Pile

(*Continued from page 12*)

garded as absolutely certain of success. Besides, the coal is damaged not at all or only in a very small degree. There is one possible objection and that is the coal comes out of storage in a wet condition. To some, this is no objection at all. Practical people have accepted this method. Thus, the Omaha Electric Light & Power Company, Omaha, Nebraska, constructed some years ago a concrete lined storage pit where provision was made for submerging the coal up to a certain level. The Underground Railways of London did a similar thing at the electric generating station at Lot's Road, only their container was constructed of steel. The Omaha pit can submerge 6,000 tons of coal and the London tank 15,000. Another instance is the big storage pit of the Duquesne Light Company of Pittsburgh which is located on Brunots Island. This is a large affair as the plan area of the pit is 800 x 150 feet and the depth is some 25 feet. The bottom is horizontal and the sides are set at an angle of 45 degrees. The United States Government may also be cited. That is, at the Panama Canal, the coal storage plants were constructed so as to provide for a large amount of submerged storage. It may be that the Navy has no special need for such storage because of the growing importance of oil, but the fact remains that the method of storing under water was regarded as quite the thing. The submergence provided extends to a considerable depth.

Where a big amount of coal is kept principally as insurance against strikes and other difficulties, submerged storage may seem very suitable even to those who wish to recover dry coal for the ordinary daily use. The submerged portion of the pile could represent the emergency coal, and there could be a dry pile on top which would contribute the ordinary supply. The coal would be wet for perhaps a foot above the level of the water used for submergence. Furthermore, if the water is under absolute control, the pile need not be subjected to any submergence at all, under ordinary conditions. Upon discovering that the pile was on fire, the water could be turned



HOW THE "MORSE MARBLE GRAB" DEVELOPED FOR THIS WORK FURTHER FACILITATES MARBLE HANDLING

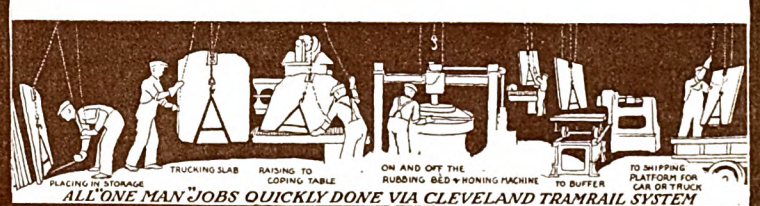
A Crying Need in the Marble Cutting Works Because

Marble weighs 14 pounds per Sq. Ft. It takes 4 Men to handle an average slab. Larger slabs require 6 to 8 men. ***THE CLEVELAND TRAMRAIL and ONE MAN*** can do it easier and quicker. It takes much valuable time of 4 Men or more to lift it upon various machines and remove it again. ***THE CLEVELAND TRAMRAIL and ONE MAN*** can do it easier and quicker. It takes up much valuable floor space as trucks clutter up the floor in going from operation to operation. ***THE CLEVELAND TRAMRAIL uses the ceiling only*** for trucking. Think it over.

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WICKLIFFE OHIO.

CLEVELAND TRAMRAIL SYSTEM
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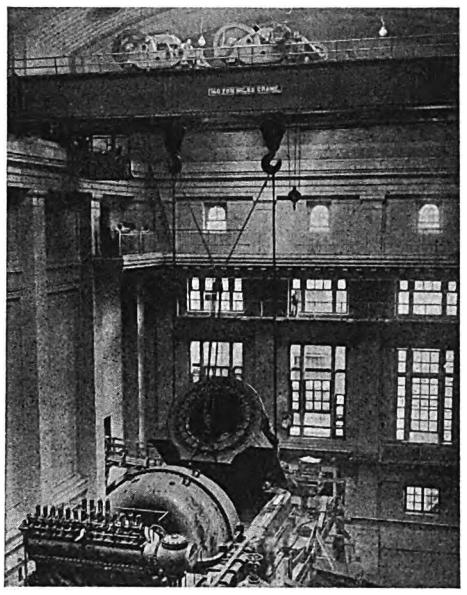
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on and the pile flooded to the pre-determined level. The fire could be put out in this way and then the water could be drained off.

Of course, there are situations where the water supply is not under any especial control, as when the ocean or a river is depended upon to flood the pile to the water level of the surface of supply.

High piling is considered to facilitate spontaneous combustion; and yet fires have occurred even in the case of low piling. Anything over 12 or 15 feet is probably more or less dangerous. Fine coal seems provocative of trouble. This is probably due to two things. First, there is the great total surface of exposure when the mass is made up of fine particles. Then there is the probability that ignition is easier when the particles are small. Heat from near-by furnaces may be considered as an aid to oxidation and would thus promote the initial movement towards self-ignition.

When special means of securing immunity against the occurrence of spontaneous combustion can not be provided and the coal has to be stored in big pits, perhaps the best thing to do is to watch the piles. This may be done by the use of testing rods inserted here and there and left in except at times of inspection. If the lower ends of rods show a rise in temperature, the location goes under suspicion at once. Attention should be given to this and similar locations at fairly frequent intervals. If the temperature keeps on rising, the situation calls for treatment. If the coal can be dug out and burnt, this is a very good plan—one of the best. Treatment with a hose giving only a small stream of water may only result in wetting coal around the infected spot down in the pile. With coking coal a roof of coke is to be expected to form over the fire and constitute a kind of shield against water from above. Of course, if the whole pile can be flooded up to and above the level of the trouble, this can be relied on.

There seems to be more or less disagreement as to whether it is dangerous to store coal that is wet—as from rain. There is some evidence which points to the possibility that the storing of wet coal is not the best practice. Thus, some years ago, two coal piles in bins that were alongside each other were stored, the one with coal in a dry condition, the other with coal that was wetted down as it was put in. I don't know the depth of the coal in these piles, but for 60 days the temperature went up in the pile stored dry until the temperature level was nearly 400° F., when the experiment was halted lest the coal ignite. A nice case of spontaneous combustion was the only way no doubt. With respect to the coal stored wet, the temperature rose to 138° F., and then dropped. There is some experience with Government storage that tends to substantiate the foregoing. A certain U. S. Paymaster seems to have paid attention to the results of storing wet and dry coal. Spontaneous ignition occurred in both classes of cases, but there was less trouble with coal that had been stored wet. It is proper to add, however, that there seems to be some evidence tending the other way. Apparently, we are not entitled to come to a final conclusion on this point. We can hardly view either coal stored dry or coal stored wet as immune against self-ignition.

There is a method of piling that has been recommended. I doubt, however, whether the matter has received full scientific attention. While that is being awaited, we may perhaps do well to consider the method. When the coal is being stored by the aid of the grab bucket, it is recommended that the individual bucket loads be dropped at once and that in this way a small conical pile be avoided. It is thought that a big pile consisting of such small conical piles is improperly constructed, and that it should rather consist of flatter masses. When the bucket is permitted to let go the load by degrees, there is, it seems, a tendency to form a cone, consisting of fine coal more or less separated from lump. The lump coal is thought to facilitate the passage of air because of the partial absence of fine coal to fill up the voids. The formation of air vents through the coal would probably endanger the pile because they would likely promote circulation and oxidation.

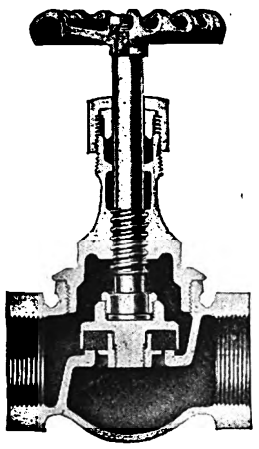
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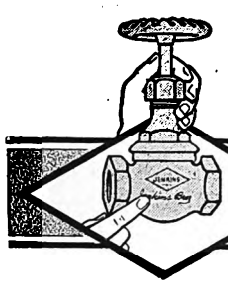
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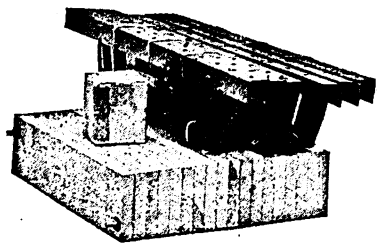


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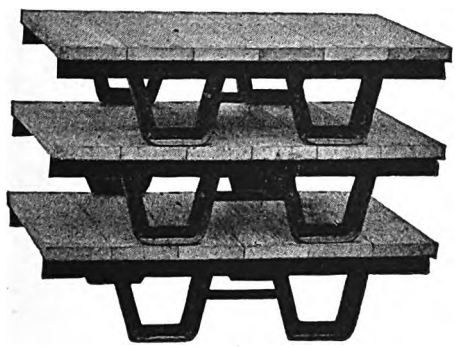
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That air in contact with coal oxidizes it more or less seems to be indicated by the case of a certain coal mine in Great Britain. The temperatures at the bottom of the shaft were taken of the incoming and outgoing currents of air. There was found to be a difference at 17 Fahrenheit degrees. Now part of this difference could be accounted for by the fact that generally a shaft grows warmer and warmer the deeper down it goes. This has nothing to do with oxidation. In the present case, the depth of the shaft was such that about one-half of the 17 degrees could be explained on this basis. Then a very small amount could be accounted for by the presence of men and animals in the neighborhood. But this was insufficient to cover the entire balance, so that it would seem that the continued slow oxidation of the exposed coal was really a cause of part of the heat.

In order to know from time to time whether the temperature down inside of a pile is increasing or not, we may use the following method. We provide a series of temperature wells at intervals of 30 feet along the center line of the pile. A 2-inch pipe is used which is long enough to reach down through the pile and be driven several feet into the ground and also to extend above the top of the pile for a convenient number of feet. These pipe lengths may be made pointed at the bottom to facilitate driving. Before setting the wells, each piece of pipe has a series of five or six holes drilled into its wall, these holes being at intervals of 1 foot, one hole above the other and the lowermost one down near the ground. At the upper end each pipe length is provided with a cap. Assuming now that the pile is a long prism, flat on top and not more than 12 feet high, the wells will be accessible to a man whose duty consists in walking along the top and ascertaining the temperatures down in the pile. He unscrews the cap and lets down an armored thermometer which he permits to remain down for 10 minutes. In this period, the thermometer will presumably have acquired the temperature of the lower part of the pile. When it is withdrawn, if the reading is as



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high as 140° or 150° Fahrenheit, then prompt attention is to be given, and the infected coal dug out. The six holes that are drilled in the pipe lengths may be of half-inch size.

The piles where the coal is stored may have sides that slope 1½ on 1. This will be considerably steeper than 45 degrees which is 1 on 1. With a 6-foot flat on top and a height of 12 feet, such a pile will be just 22 feet wide at the bottom. Some coal can be piled more steeply than others. Where the slope needs to be less steep than 1½ on 1, the base will accordingly be widened. It has been suggested that a white band be painted around the pipes to cover the interval from the 12-foot level to the 13-foot level. This white band, 1 foot broad, will then serve as a marker to show the storage man exactly when to stop piling.

When a number of such piles are to be placed parallel to one another, a space is to be left between rows to facilitate air circulating on the outside. A very good rule to follow, if it seems desirable or necessary to modify the dimensions already suggested, is to pile the coal so that no interior point will be more than 10 feet from an exterior, air-cooled surface.

If coal cannot be piled in prismatic rows, but must be stored in a single flat stratum, then the depth should be reduced—say, to six feet.

It is considered inadvisable to store coal immediately or very shortly after it has been cut out of the seam in the mine, as freshly mined coal seems to be quite susceptible to oxidation. The piles should be inspected for temperature not less often than twice a month, if there is any real danger of self-ignition.

The following rules will be of more or less service.

1. Store the coal only in low piles—under 12 feet.

2. Make the piles narrow at the base—say, not over 20 or 25 feet—and with a 6-foot flat at the top.

3. Provide temperature wells at intervals of 30 feet or less.

4. Pile the coal to a height of only 6 feet, if it is not possible to pile in long prisms.

5. Use temperature wells in this case also, setting them so that no point in the pile is more than 15 feet from a well.

6. In whatever way the wells are set, let their temperature near the bottom be ascertained every 10 days or every two weeks.

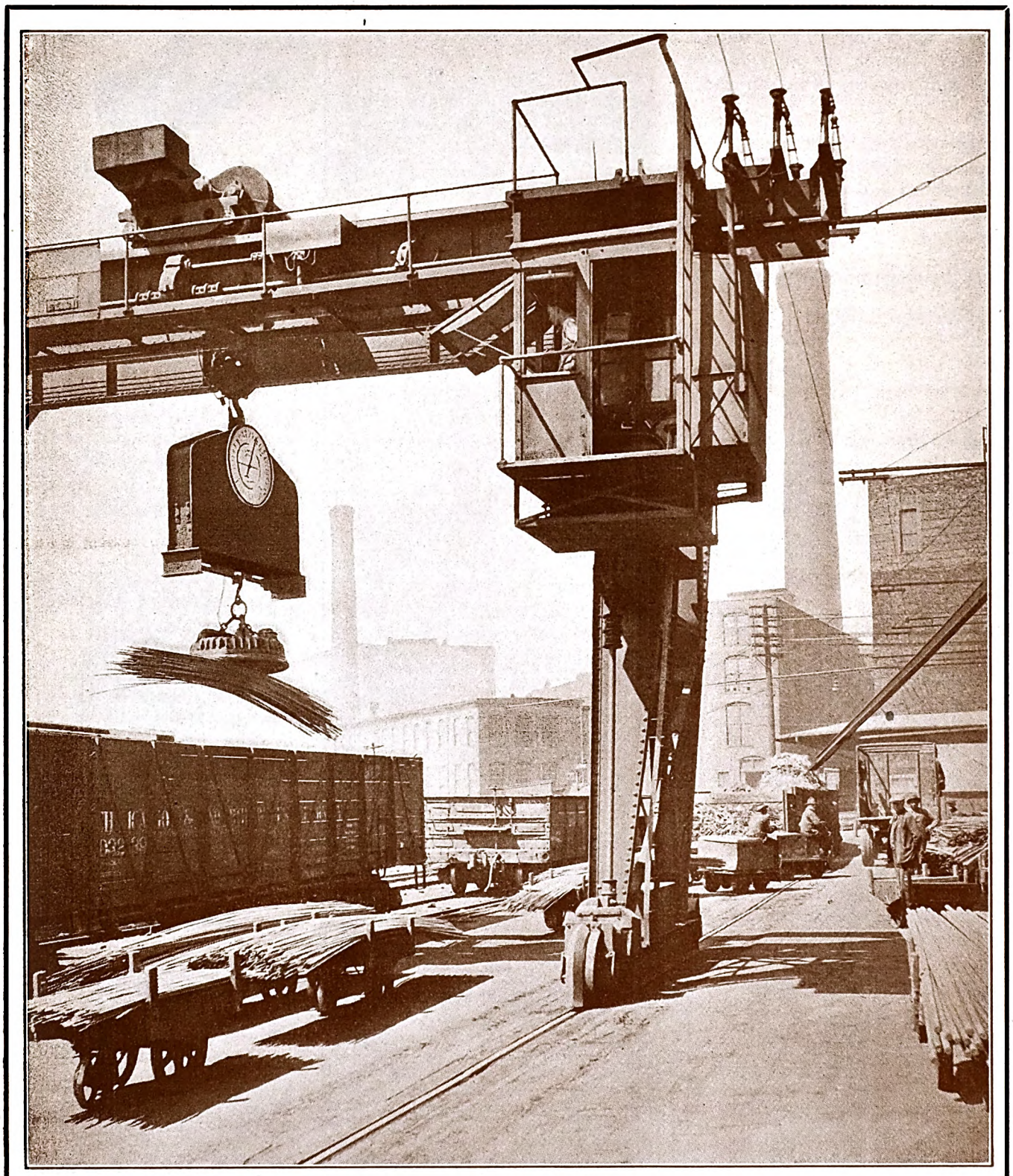
7. Avoid the inclusion of fine coal in the pile.

8. Dump the bucket load suddenly, so as to avoid building up small cones in which the coarse and the fine are more or less segregated.

9. If the coal contains sulphur in the form of iron pyrites, or in fact any other material having a strong appetite for oxygen, then the coal is to be very carefully stored and very carefully watched. After the lapse of two months, it is recommended that the coal be rehandled and rescreened. Further, it is advised that such coal be allowed to "season" for six months before going into storage.

10. Seek to locate the coal in storage where there will be no exposure to sources of exernal heat.

These rules apply mostly where the method of storage



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falls short of that which depends upon submergence under water, which may be regarded as practically ideal in so far as the prevention and control of self-ignition is concerned.

The writer recently addressed an inquiry to the Omaha Electric Light & Power Co., for whose service the wet storage pit illustrated in this article was constructed. The point raised was whether their experience had been satisfactory. In reply, under date of April 16, 1923, the General Superintendent of the Nebraska Power Company, the present owners, says:

"Most of the coal we purchase in this part of the country could not be stored in any other manner with safety and the coal pit has therefore fulfilled the function for which it was purchased."

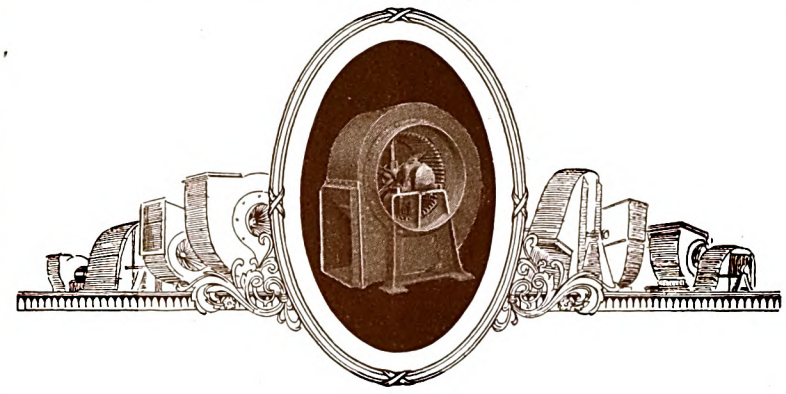
Shooting Big Game, Pictures, and Cement

(*Continued from page 21*)

Between taxidermy and facing the crumbling walls of the Culebra Cut with indestructible concrete, or shooting up great Government warehouses at the seaports almost overnight during the war—what is the connection? What has the goggle-eyed stuffed lynx I remember in the dusty shop window near my boyhood home to do with twentieth-century Erie Canal Barges, beautiful bungalows in California, and great sea-walls that defy the ravages of storm and frost and insects on the stern and rock-bound coast of New England? The connection is not a long chain of intermediate links; it has just one link. If there be a moral to this brief sketch, it is a moral for fathers: Let your boy follow his bent, whatever it be, however far removed it may seem from the practical affairs of life he will have to face in manhood. Civilization is being built up by the broadening of man's powers through discoveries and new uses of Nature's powers. And the new must, in the nature of things, come from the unaccustomed, the imagination, the unobvious—the impractical, if you please. Give him his head. His head is his own.

Carl Ethan Akeley was born on the 19th of March, 1864, on a farm near Claredon, Orleans County, New York. When he comes to die, he is afraid it is more likely to be from the perils that stalk the streets of the cities of civilization rather than from the lesser dangers of the African jungle where he is at least as much at home among the wild animals and savages. Roving free as a country lad, he hunted rabbits and chipmunks, squirrels and quail,—sport for which every city boy envies the farmer boy. And there he found his boyhood passion, his life work. Tracking his quarry, the battle of wits between hunter and hunted, the true shot which ended the chase, these were exciting enough, to be sure. But this boy soon found something more than the ephemeral thrill in the close observation, the learning of the ways of wild birds and animals which the hunter necessarily acquires and practises. Instead of mere means to the end of killing the game, to him these became the interesting thing.

In a crude way he stuffed the skins and mounted them. What he did when it came to the eyes doth not appear. When, as a boy of sixteen, he announced himself to the world as a taxidermist, by way of those bravely printed cards, probably he was as good as all but a very few professionals of that time. Having finished school and looking for employment, a wise friend suggested that he might find a congenial place with "Professor" Ward of Rochester, who did an extensive business in taxidermy. He did. The "state of the art" in those not very remote days may be judged from the fact that when a skin was to be mounted it occupied practically the same position in the economic or social scale as a rag bag. That is to say, it was stuffed with hay, straw, hair, rags and



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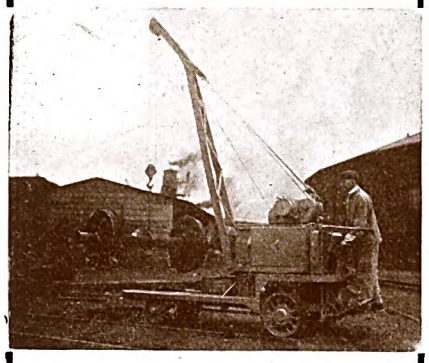
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paper. The skull and the leg bones usually were inserted. When it was packed full, when the glass eyes were in place, and the whole wired or nailed to a board so it wouldn't fall over, it was a finished job, ready for the customer's mantel piece, or for the natural (!) history museum. "No such idea as that of studying the anatomy of the animal, as a basis for posing it, had ever occurred to the mind of a taxidermist," says Mr. Akeley. Very likely no taxidermist ever had approached the practice of his profession by the route which led this boy into it—long observation of the animals in life and action, so that he knew intimately how they should look when mounted in order to be lifelike. It was natural that a boy who had thus studied his subjects in the field should dig into the writings of others who were his kindred spirits in the study of wild animals, and by that means increase and co-ordinate his knowledge of anatomy, coloration, habitat and distribution of species, preservation of skins, and everything else that would put solid, scientific foundations under his temperamental inclination to preserve the wild things of the fields and woods with fidelity to life.

So he grew both ways, like a good tree, striking roots deeper and deeper down into the sources of knowledge, and branching out in originality. His first creative work consisted in posing his stuffed animals in natural attitudes and groupings. Then he went a step farther and painted, perhaps rather crudely at first, backgrounds which represented the season of the year and the other natural surroundings in which the subject would be found in life under the circumstances indicated by the condition of the animal's fur, its sex, age and pose. All that was as new in taxidermy as though, after men had made sounds for generations, it had suddenly been discovered by some bright individual that sounds could be utilized for speech.

To the upholsterer-animal stuffer a deer was a deer, No, it wasn't even that; it was merely an animal, with four feet to be nailed to the mounting board instead of the two



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which birds had. To this young enthusiast the particular subject was a great deal more than a mere quadruped, something more than a deer, even. It was for example, a doe; a two-year old doe: a two-year old doe from Northern Maine; a two-year old, North Maine doe in the spring of the year. Therefore she must be mounted with a fawn at her side and the verdure of spring about her, to complete the picture into which she would fit without doing violence to Nature. Do you see the *art* of taxidermy coming into being in the thoroughgoing brain and under the loving fingers of this lad who had roamed the countryside with his dog, his gun, his eyes and his mind all busy?

While working at Ward's museum in Rochester he managed to complete his schooling —his schooling, not his education—at the State Normal School at Brockport, New York. After four years spent in this way, at the age of twenty-three he went West, figuring there was more game to be hunted and more proud hunters who would want their trophies of the chase mounted than in the East. To go West is of course a purely relative expression. If you are a Bostonian, going to Rochester is going West. If you are an Oregonian traveling to Butte is going East. However, young Akeley went West to Milwaukee and worked in a museum there, far enough away from Ward's to be beyond hurting or being hurt by competition. It was perfectly natural that his notions of animal stuffing and mounting were too newfangled for an established business, so he had to work them out in a shop of his own. The results attracted attention from curators of the really great, non-commercial museums and, after eight years in Milwaukee, the long arm of the British Museum reached out, tapped him on the shoulder and beckoned him to its service.

Unfortunately for the British Museum, the way to London from Milwaukee lies through Chicago, and the traveler has to change cars there, which Akeley did. And not only that, but there were some hours between trains, affording the foot of the restless traveler the desire and the time to go somewhat about the city, which Akeley did. And not only these, but Chicago possesses, and possessed then, the Field Columbian Museum. Where else would this particular traveler spend his sightseeing hours than there, among the objects of his life long interest, and among men whose interest was the same? What more natural than to visit with them and, in the course of conversation about this and that, to mention why he happened to be there? And what more inevitably consequently than for those quick-fire Chicagoans to end his journey then and there? They pointed out that there were plenty of specimens awaiting his art and skill, and he could begin being happy right away, without losing a week traveling by train and boat to get to work. Eventually he did reach London, but it was in 1896, as a member of the Field Museum expedition to Africa. On that trip he accompanied the curator. In 1905 he headed the museum's

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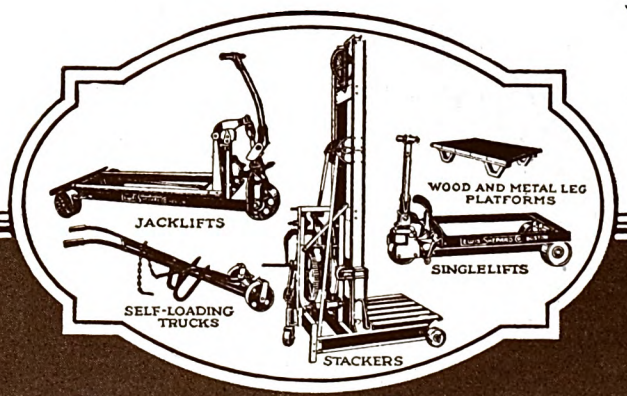
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This Private Automatic Exchange is designed primarily to give instant communication within an organization simply by turning the dial. Short distances may cause costly delays. By making it unnecessary to walk to talk North P. A. X. makes it easy to get things done.

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"Your Whole Organization at Your Finger Tips" is the name of a new bulletin, illustrating the many ways North P. A. X. saves. Glad to send you a copy—and we think you'll be glad to get it. Just say the word.

The
NORTH ELECTRIC
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In addition to North P. A. X. this company manufactures the most complete line of machine switching equipment for city telephone exchanges. Manufacturers of telephone equipment since 1884.

African expedition and brought home a priceless bag of specimens. Those trips were enlivened by such incidents as fighting and killing a leopard with his bare hands.

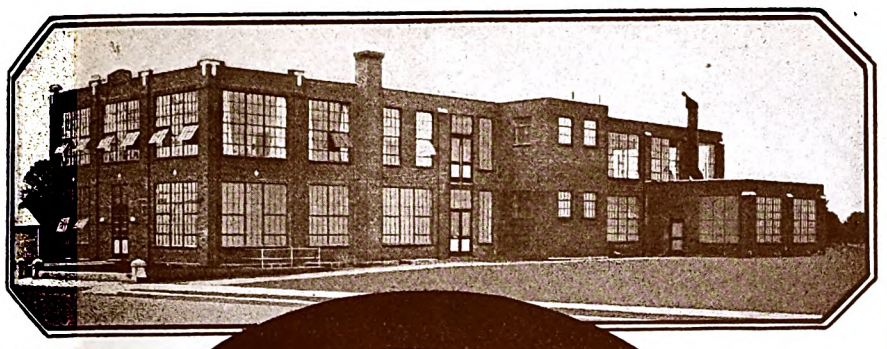
During those years his creative genius was given free play, and gradually the revolution of taxidermy from the rag-bag stage into an art progressed step by step. Those steps included not only the posing of the specimen and the reproduction of appropriate scenery, but the equally important and revolutionary displacement of mere stuffing by the mounting of the skin on a light manikin, anatomically and artistically correct, unchangeable in form, and indestructible by decay, moisture or vermin. All this was accomplished not by mere dreaming but by the sweating, dogged plodding which genius alone seems able to endure when, driven by no boss nor by economic necessity, it sets itself to the task of realizing its visions.

During those plodding years Akeley had to make himself an animal sculptor, so as to execute plaster models for his manikins that were not more lay figures to tack the skins upon, but which should have the touch of genius that would impart expression, action, life. And at the same time there was the purely mechanical drudgery, the countless experiments with materials and methods, trying and discarding, one after another, this substance and that, one way of building up a body or fastening sections together, and then another, until at last perfection was achieved. Now, the perfected method begins with the animal in life. Continually photographs are made of the wild animals in their free state, in every procurable act of their lives. These, for the purposes of taxidermy, provide suggestions for the action to be represented by the finished mount and they give the exact relationship of the several parts of the animal's body in the posture in which it is mounted. And, lastly, they picture the natural surroundings of the specimen. The instant an animal is killed, every measurement of the body is made on the spot and carefully noted down. These measurements may run into the scores, and they must be made quickly before there is any distortion by *rigor mortis* or dissolution. Next, the removal of the skin of an animal killed for museum purposes must be done not only at top speed, but also with extreme care to avoid tearing. The task of cleaning an elephant's hide of the bits of flesh which come away with it in the skinning, and which would endanger the pelt by putrefaction, must be given the closest attention, though it may take three or four natives several days to do it. Drying the skin, and packing it for transportation to the shipping point through the humidity and vermin of the tropical jungle or the brittling Arctic frost, demand forethought and resourcefulness in the highest degree. No queen's glove is tanned with the care that is bestowed upon the pelt of a museum specimen by the present-day taxidermist.

Arrived home, Mr. Akeley—no, he is not known as Doctor Akeley—with his photographs and measurements taken in the field, with painstaking care and with sculptural skill that has gained him membership in the National Sculpture Society, proceeds to model in clay each animal whose skin and skeleton have been brought home, in the desired pose. This model represents the skinned body of the animal. A plaster of paris mould is made of the model, the mould of course being a reverse, or negative. Within this mould the manikin is formed, so that the manikin in turn is a positive, an exact replica of the model.

This is the Akeley method of making it. The mould being cut into convenient sections for working, the inside of a given section is first brushed over with a coating of glue. Then a sheet of muslin is laid on and carefully worked and pressed by hand into every undulation of the surface. Next a sheet of wire netting, usually of about 3/32″ mesh, is worked in in the same careful way. The moist papier machè is applied and worked into the meshes so thoroughly as to adhere to the muslin throughout its entire surface, thus binding the muslin and wire mesh firmly together. Another layer of wire mesh and papier machè is added and, according to the size of the animal, still other

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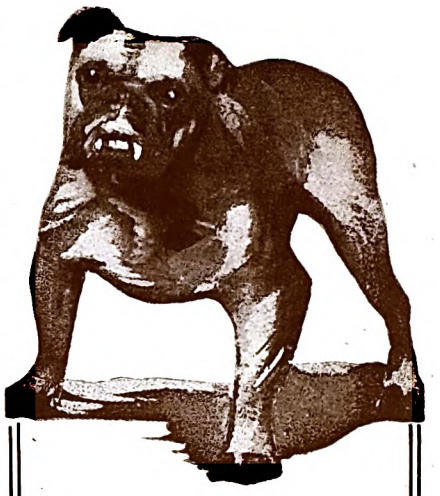
SERVICE

layers, until the finished shell is from an eighth to a fourth of an inch thick. Thin and light as it is, the strength of the finished manikin is surprising. These, of course, are no slight advantages, particularly with the larger animals, when it comes to shipping or handling them in the museum. The glue being soluble, the section is soaked in water and the shell thus removed from the cast. The several sections of the manikin are fastened together on thin ribs overlapping the joints inside. And last the glass eyes, made with utmost fidelity to nature, are wired in, the skin is glued on, and the long process of procuring and mounting that specimen is completed. As some one has said enthusiastically, the animal now has been made to live forever, for, apart from actual disintegration of the hair and skin through the slow process of mere time, and barring accident, the specimen thus prepared is indestructible.

So much for Carl Akeley, the taxidermist and artist. Now step around to another side of him and consider him as an inventor. In his creation of the art of taxidermy the inventive faculty incidentally served him well. But it is more than sporadic or secondary; it is a coördinate power of a many-sided intellect, supported and made effective by the moral trait of thoroughness and invincibly patient industry.

It will be remembered that the Field Museum was established as a unit of the Chicago World's Fair and that, like all the other exhibits, it was housed in a frame building with an exterior of "staff." The temporary nature of the structure made itself only too plain in a few years by the cracking and falling away of sections of the staff coating, not only giving the building a dilapidated appearance, but letting in the wind and cold and promoting more rapid disintegration of the whole structure. Akeley was familiar, as the whole world was familiar, thanks to the Fair's efficient publicity department, with the then novel method by which the acres of wall space of the Fair buildings had been covered with paint—sprayed on by compressed air. In his

(*Continued on page 57*)



Keep this Watchdog on your Boilers

Your dog keeps away tramps, burglars and thieves from your home—he is your insurance of safety—you feel secure in leaving your home in his care.

What similar kind of safety insurance do you have in your plant boiler room? What protection have you against accidents to your boilers?

This new Powell Valve will give you just that kind of protection.

A New Idea. Nothing like it on the market.

Its automatic *triple action* immediately closes the feed when a tube bursts—isolating the boiler.

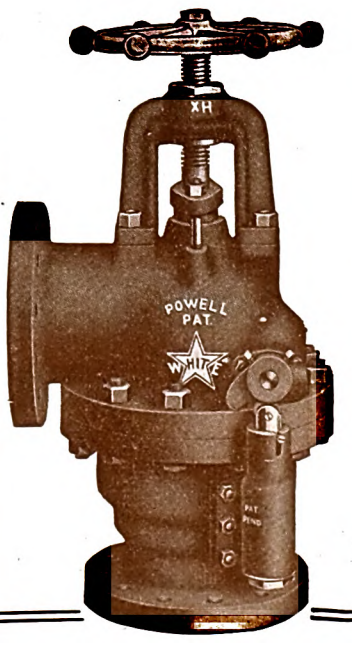
The new Powell Valve is backed by seventy-five years experience— absolutely dependable—vitally necessary to all plants running two boilers or more.

Our new circular tells all about their action which will help you towards greater boiler room efficiency.

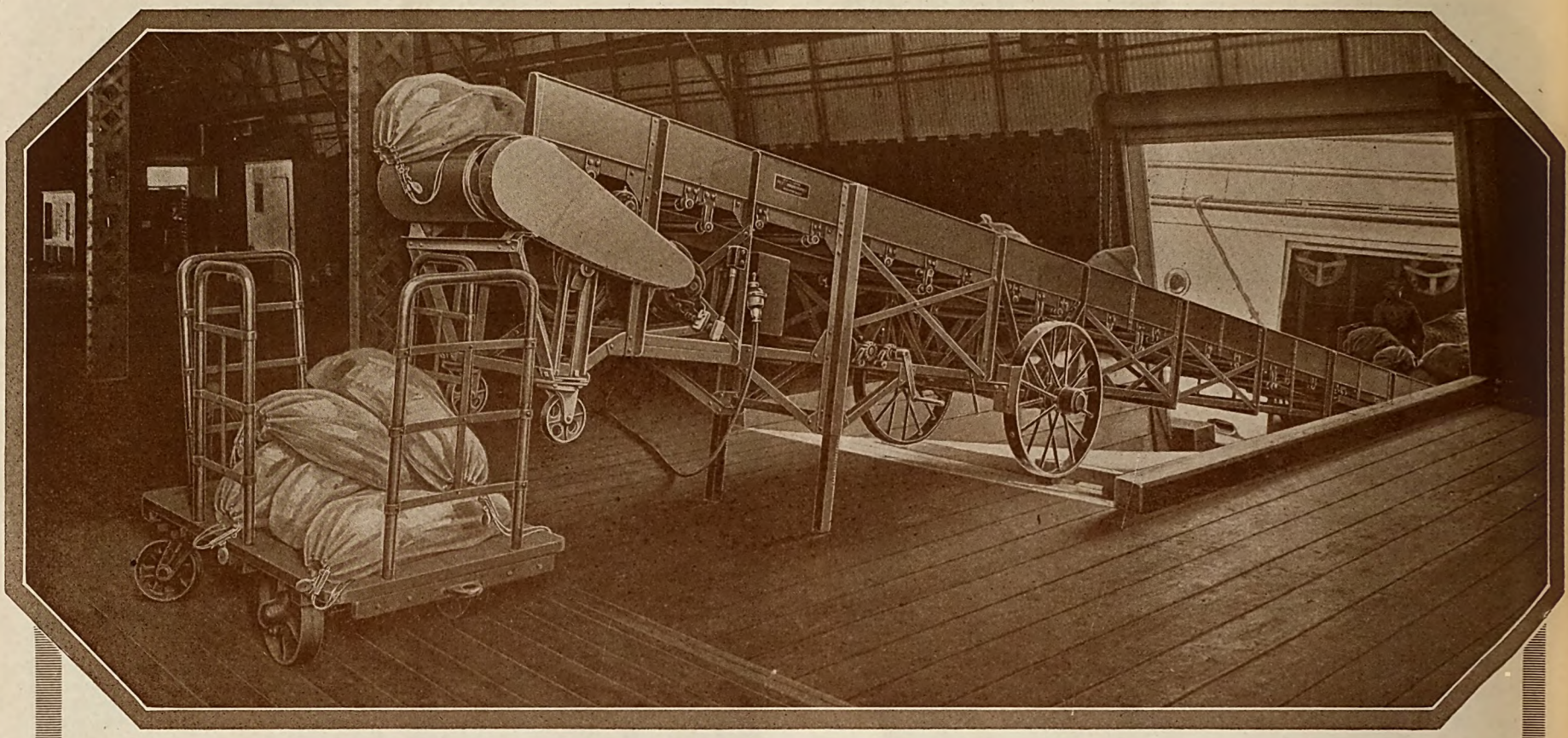
Write for it. It's free.

The Wm. Powell Company

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Have you given the question of Material Handling in your establishment the proper consideration?

It is a big problem worthy of your serious thought because so much depends upon how you handle materials. Take for instance the selling price of your product, if you are a manufacturer. Production without any question determines it. Conveying systems are the means of establishing and controlling production, inasmuch as they keep materials on the move continuously, so that all productive machines and assemblers produce to their utmost capacity.

The cost incident to the receiving and storing of raw materials as well as the shipping of finished product effects the selling price of your product. Rather than the slow moving elevators or trucks requiring attendants, materials can be elevated, distributed and lowered by automatic conveyor units with far greater rapidity at an insignificant cost.

Are you satisfied that your material is being handled properly? Are your operators and assemblers supplied with material? How much time is required to load cars or trucks? How long does it take to unload and distribute a car of raw material? If the remotest doubt exists in your mind allot a few hours to a survey of methods used.

We will gladly have one of our engineers make an analysis of your material handling problem and advise the type of Conveying System which will reduce your handling costs to a minimum.

SAMUEL OLSON & CO.

Loose, Bulk and Packed MATERIAL HANDLING SYSTEMS

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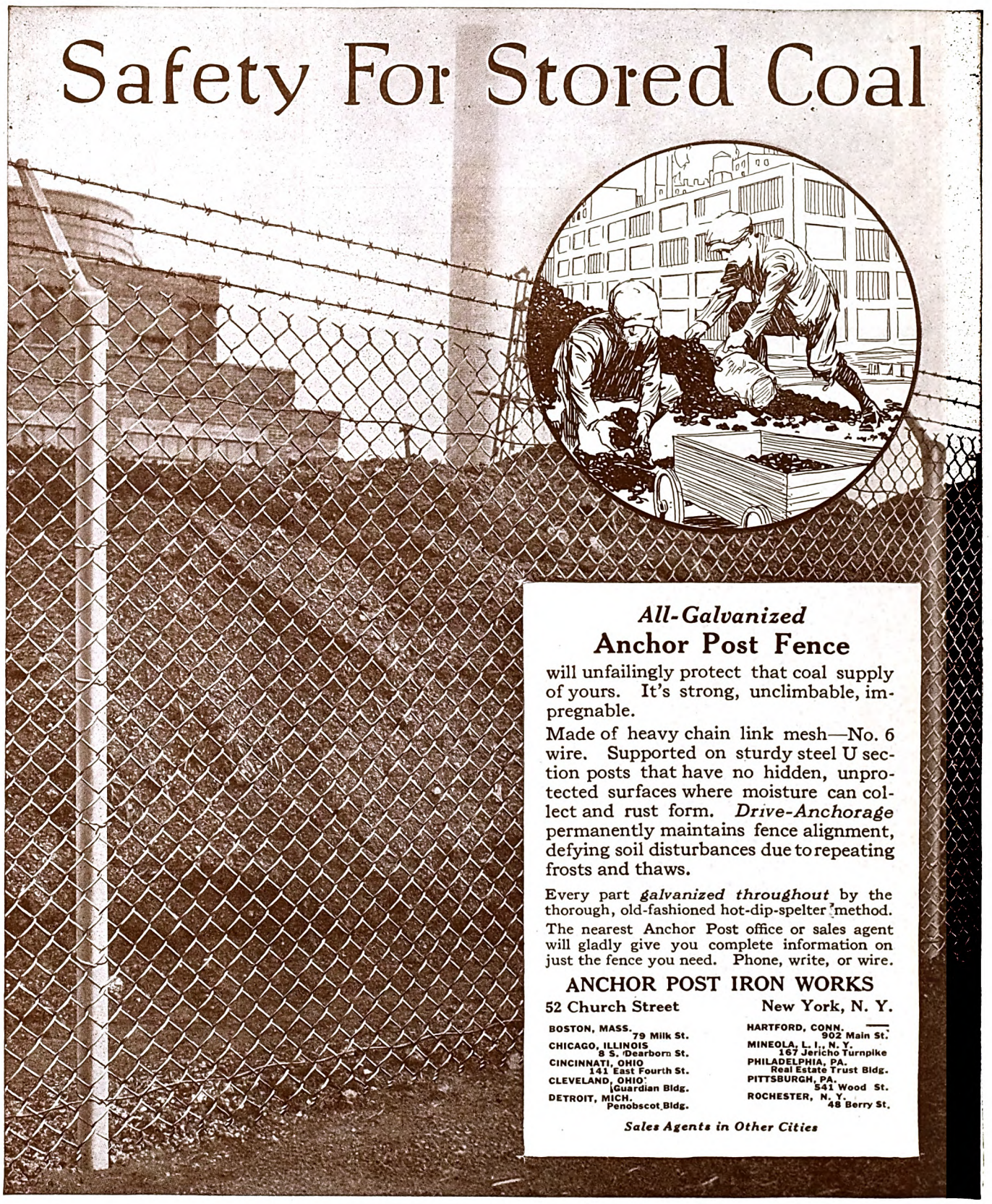
(*Continued from page 55*)

own work from time to time he had had occasion to apply coatings to his models by the same spraying method. One day, as he glanced at the familiar, unsightly, ruinous walls, the thought flashed into his mind: *why* not apply a coat of cement or concrete in the same way the coat of paint had been put on? He set to work. The thought was brilliant, but the way to materialization of it lay through prosaic toil, endlessly discovering obstacles and devising ways to overcome them. Hitherto nothing but liquids had been sprayed. This involved spraying solid materials. More than that, it necessitated blending them with each other and with water, in accurate proportions, not as a thin liquid, but to a thick, pasty consistency. Moreover they must be applied, not in a thin coating on the surface to be covered, but to a considerable thickness, and the coat must have body enough to stand up on a vertical surface and not run off by its own weight. Still again, chemical reactions between the materials made them begin to set immediately upon mixing, a fact which must be taken advantage of and not permitted to interfere with the operation of the apparatus or the physical behavior of the mixture within the machine or on the surface being treated.

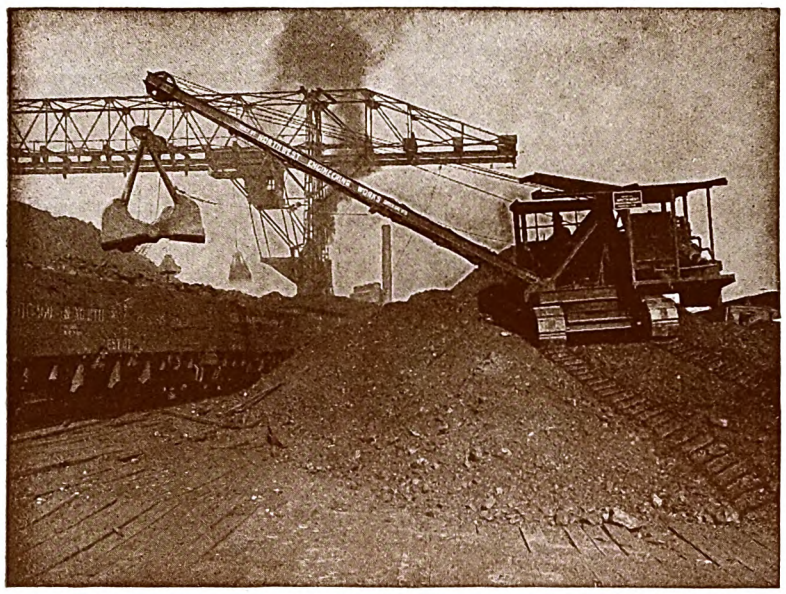
Methodically, one after another of the problems were disclosed, studied, experimented with, solved—and the "cement gun" shot new walls of "gunite" on the Field Museum. The material was christened gunite because, while it consists of the same sand, cement and water as hand-mixed concrete, its proportions and consistency are materially different. This is owing to the fact that they they are practically blended at the moment of application to the surface instead of being first mixed and then transported to the point of application. This difference in the time the setting reactions have to operate in, permits a more advantageous proportioning of the ingredients which, together with other advantages, gives the finished mass a very considerably greater density and strength than concrete mixed in the usual way and applied by trowel or by dumping or pouring into forms. That greater strength cannot be expressed in figures without using a technical table which has no place in this article.

To describe the cement gun in a sentence or two, it consists of a tank on two wheels which permit it to be moved about as the work progresses. It has two chambers divided by a horizontal disc wheel whose rim is notched with teeth. The dry sand and cement are mixed and fed into the upper chamber. The revoluing disc, or "feed wheel," as its notches pass the opening into the lower chamber, permits the mixture to drop in small quantities into the latter. From there small charges are blown by compressed air out through the rubber hose held by the workman. At its nozzle the water is introduced, and the compressed air carries the

(*Continued on page 59*)



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Climbs with ease

Mobility is one of the paramount reasons for Northwest economy. Ability to climb up over piles, in and out of the rough and irregular places and handle material from practically any angle speeds up operation and reduces costs.

This is accomplished by means of the famous Northwest Crawler Base—a Northwest steers like a truck—and is as easily handled.

High flexibility of power, simplification of mechanism and control make it a popular machine with every man that has used it—there are no fires to pull, no dials to watch—it is always ready to run and it always runs when the operator is ready.

Let us tell you what they are doing now —and what they will do for you.

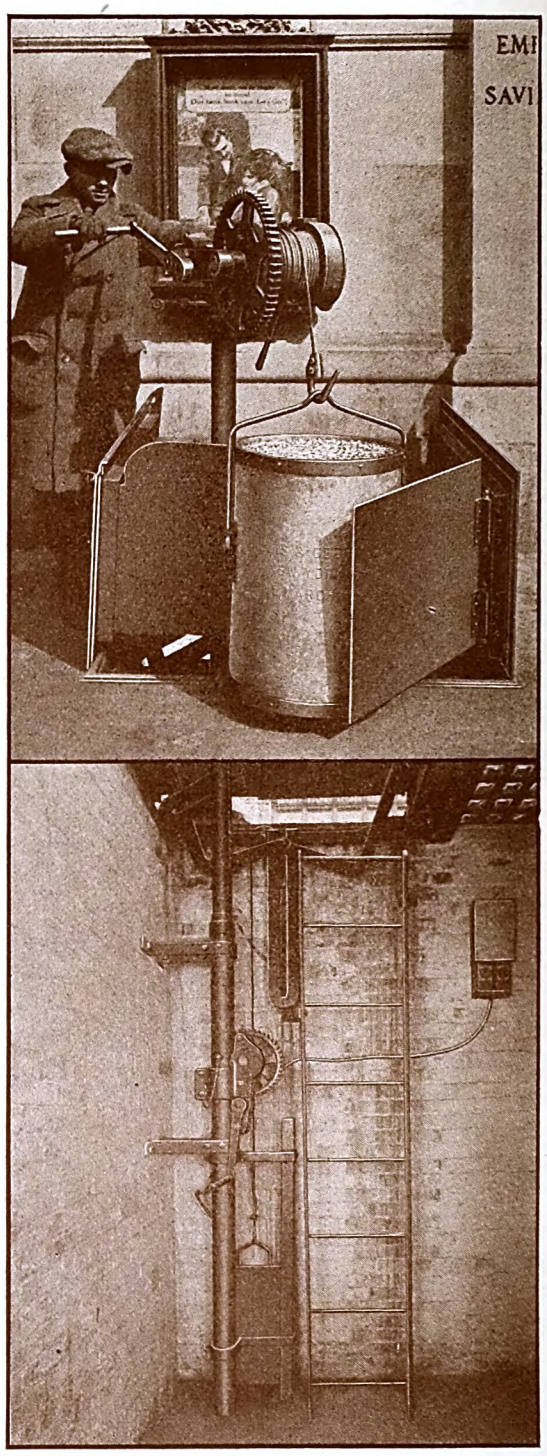
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NORTHWEST

CRANE
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Easily operated by One Man

THE G & G Model A Telescopic Hoist illustrated is particularly adapted to the removal of ashes from moderate sized buildings. Also used inside factories and warehouses for handling loads under 1000 lbs. For handling a heavy volume of ashes our electrically operated Hoists are recommended. Get the complete story of this time and labor saving equipment.

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The G&G REG. U.S. PAT. OFF.

Telescopic Hoist

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(*Continued from page 57*)

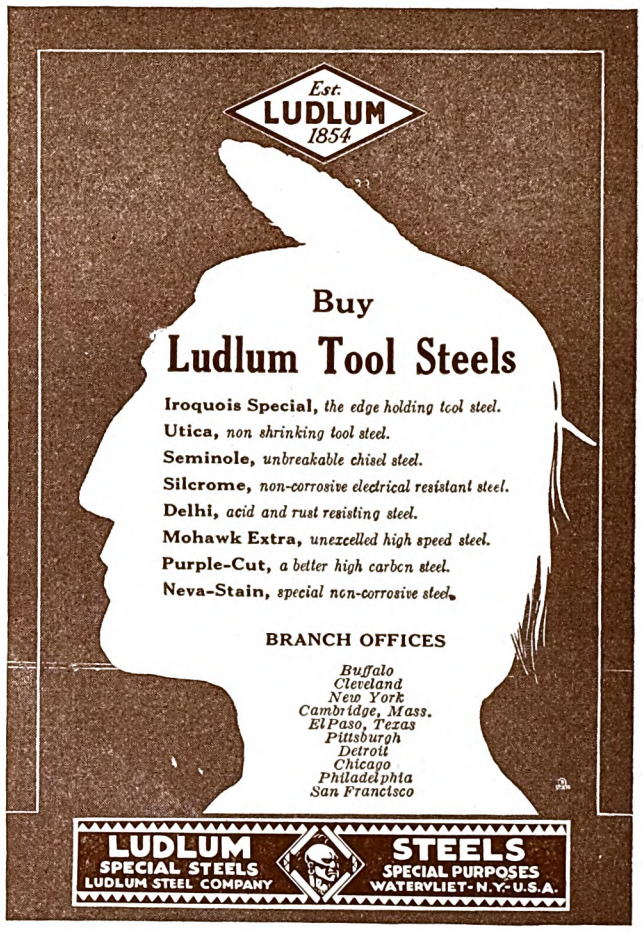
completed mixture in the form of "spray" to the surface which is being coated.

An almost endless list could be given of the uses to which the cement gun already has been put since it was introduced to the public at the 1910 Cement Show in New York. In the great majority of cases a wire screen is set one-quarter of an inch or so away from the surface coated, the distance and also the weight and mesh of the wire screen or metal lath being governed by the thickness of the concrete coating. One of the great savings accomplished by the cement gun, besides time, is elimination of lumber forms. This has made possible some uses of concrete which previously were impossible or so difficult or expensive as to be impracticable. Among them is that strange thing to the lay mind, the concrete ship. Another is in mines, where it shoots heavy reinforcements of gunite which hold up crumbling walls and roofs where it was impossible to apply the necessary thickness of concrete and give it the adhesion required, with a trowel or by means of forms. Old houses, new factories, California villas, are covered, over the old wooden framing or the new steel skeleton, with concrete that is not only as durable as the Pyramids but beautiful in texture and color, when those effects are desired. In the industries it is used, among innumerable other ways, to line furnaces, kilns and cupolas far more quickly, and often more durably than can be done with brick. In marine engineering, piers and piling, seawalls and linings of canals and basins, are built up and repaired with this device and the material which is its working mate.

We are not through with Carl Akeley's major inventions. He was among the first to take a motion picture camera into the field of game hunting, because he wanted to get the largest possible number of true pictures of the postures of his subjects for preservation in permanent form. He soon found that the instrument which had been perfected for the studio had very distinct limitations under the rough-and-ready hazards of a faunal expedition in the wild corners of the earth and in the climates there encountered. "There was no movie director," says Mr. Akeley, "to tell my untutored animal actors where to move in order to keep within the field of my camera lens, so they were apt, very often, to jump clear out of the picture at its most interesting moment. If one of my carrier-boys stumbled and dropped the machine into the river, or on a rock, it came to more or less grief, or the contained film did." The long and short of it was that again Akeley's inventive mind did not stop with cursing the short-comings of the instrument provided by others but proceeded, through some years of labor, to develop what he needed. The result was the Akeley camera which now accompanies practically every scientific expedition, whatever its purposes, wherever its destination, if photographing is among its activities.

What had to be done, to meet the requirements of scientific field work with the motion picture camera, presented a rather formidable array of problems. The Akeley camera does them all. An animal or bird cannot, except at extraordinary and never attained speed, jump or fly out of the plane of rotation in which the camera is swinging to follow its movements, as it easily can in the case of the studio camera because, in the latter, rotation in the horizontal and vertical planes is accomplished independently, and by cranking. The operator of the Akeley camera keeps it pointed at the moving subject, without cranking at all, but by the simple, natural grasp of his left hand on the single "stick" with which he not only moves the camera readily in every direction, but does it so smoothly that the picture is never jerky.

As he thus moves the camera about, the operator does not have to stoop and stretch to keep his eye to the eye-piece He follows it only in its sidewise motion; the vertical motion takes care of itself. He changes his lenses in two or three seconds from the shortest focal length to the longest telephoto. He loads and unloads the film in daylight, losing only the single inch exposed at the moment. This





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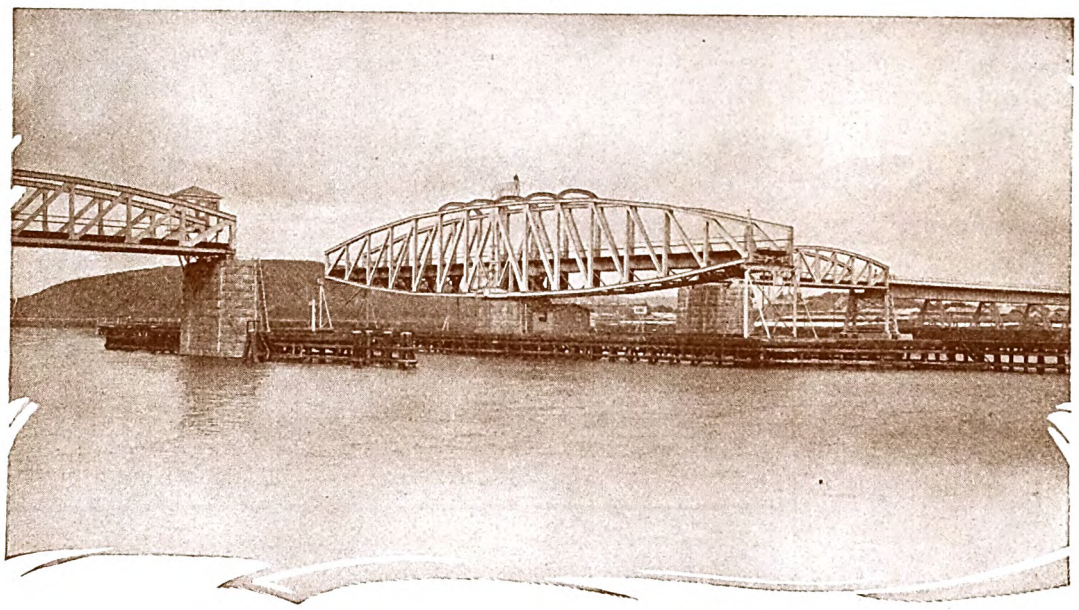
feature, since the amount of unused film is registered, enables him to use up his short ends on short pictures—an advantage not to be despised when one is leagues and weeks away from the nearest supply house. All metal, it has proved its unbreakability by surviving an airplane crash and then being picked up by the operator and used to shoot a picture of the wreck, as if nothing had happened, so far as itself was concerned. And it isn't smashed by the charge of a wild animal who knocks it over, which means that the dare-devil cameraman can grind it an instant and a half longer, and get that much more of the most thrilling movement of his picture, than if he had not only to run himself at the last eyeflicker moment, but also to get his machine out of harm's way lest he lose the whole of his work!

It is only a one-man pack. That, again, means it can be brought into almost instant action when an unexpected opportunity for a picture presents itself; there is no time lost in assembling separated parts. Water-tight and moisture-proof—that qualification, by the way, to the astonishment, perhaps, of some of us uninitiated, arm-chair and movie-show explorers, is demonstrated best, not in the steaming tropical jungle, but in the frozen North, if you please! Hear Robert Flaherty, who filmed "Nanook" in the Hudson Bay country, tell how, during a fifty-five days' journey, "the cameras had to be taken into the igloos at night, a procedure which caused them to rime up, all of which meant that once during every day of the journey they were thoroughly wet with moisture. If you were to examine the cameras today, I am sure you could not determine which one of them underwent this journey."

So the Akeley camera roams the face of the earth in its remotest corners, it soars the sky in airplanes. It follows the racing, milling players in the football games so that at the class meets of fifty years hence the players and their sons and their grandsons can raise the roof with a repetition of the cheering on the great day.

And its inventor works in a still, out-of-the way corner of the American Natural History Museum facing Central Park, back of a great family group of elephants mounted as man never mounted animals until this man did it. For its manufacture a corporation was formed, as was another to make and market the cement gun. So this one man has created an art, and he has created two new industries, where there was none before. Is it any wonder, therefore, that in his desk there reposes the great bronze medal awarded to him on October 18, 1916, by the Franklin Institute of Philadelphia "for his cement gun" since John Scott in his will directed that the medal should be given from time to time to "ingenious men and women who make useful inventions"?

SKF



Weight of Huge Swing Bridge
Supported on a Single Ball Bearing

THE pivot of this huge swing bridge which supports the weight of the span, is carried on a single SKF marked thrust ball bearing. Despite the heavy weight supported, the bridge is positive in its action for it is supported on chrome steel balls poised ready to roll between hardened races of steel. Similarly the driving mechanism is reliable in its action for it, too, is ball bearing equipped.

This installation typifies the wide adaptibility of ball bearings which are in extensive use on machines varying in nature from small high-speed instruments of precision to powerful electric generating units, car-wheel lathes, mining locomotives, propeller shafts of ships, coal driers, paper making and stone-cutting machinery, etc.

Wherever used ball bearings defeat friction which extracts its heavy toll in power loss, heat, wear, destruction and uncertainty of performance. It is because of the widely recognized superiority of ball bearings that they have met with such extensive, diversified application.

THE SKAYEF BALL BEARING COMPANY
Supervised by SKF INDUSTRIES, INC., 165 Broadway, New York City

945



Normal View

Deflected View

BALL BEARINGS
The Highest Expression of the Bearing Principle

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Magnetism and Magnetic Separators

(*Continued from page 9*)

2nd—Magnetic concentration.

3rd—The removal of minute particles of iron from a finished product.

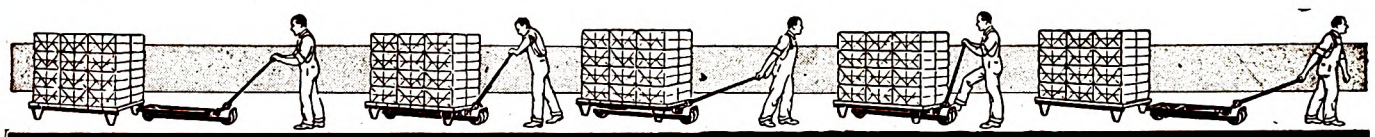
Under the first classification perhaps the simplest type is what is known as the magnetic pulley, which is built up of steel plates between which are coils connected in series. Through these, current is passed and the result is that one steel plate becomes a north pole and the next one a south pole and so on. The distance plates between these poles are of non-magnetic material, usually bronze. The wires conducting the electricity into the interior coils pass through the hollow shaft and terminate each on a slip ring upon which contact is provided through an ordinary carbon brush the magnetic pulley acts as the head drive pulley on a conveyor belt of the usual types used. The material to be separated, when it reaches the magnetic pulley is acted upon by the magnetic flux emanating from the pole pieces and those parts attached are firmly drawn downwards and cling to the belt until deflected underneath the pulley and away from the natural point of discharge.

What is commonly called "tramp iron" consisting of nails, nuts, bolts, mule shoes, drill points, etc., is the crusher's greatest enemy. Even though constructed of alloyed metals offering extreme resistance to breakage, iron, when mixed with material to be crushed always causes shutdowns and oftentimes total wrecking of the crusher. Wherever therefore, crushing is done and foreign iron, so plentiful everywhere, finds its way into the material, it must be removed. Disastrous explosion and fires resulting from sparks in high speed machinery, are avoided by eliminating the iron before the material reaches the crusher.

Tramp iron will find its way into the material to be crushed. A car of coal when loaded at the mine may have stray pieces of iron on the floor, bolts, nuts and washers in the car may shake loose enroute, and the coal itself before it has been loaded into the car may contain steel drill points, railway spikes, mule shoes and sledge hammer heads, all carelessly strewn about the mine, let alone the many loose iron parts of a car which fall off at its destination when the car in its entirety is probably dumped by turning it up-side-down.

Unscrupulous dealers in junk bone, because iron is cheaper than bone, "salt" their shipments. The same procedure is practiced by some exporters of merchandise, much iron, consigned as "cocoa beans," "tobacco," "roots" and "herbs" is ex-

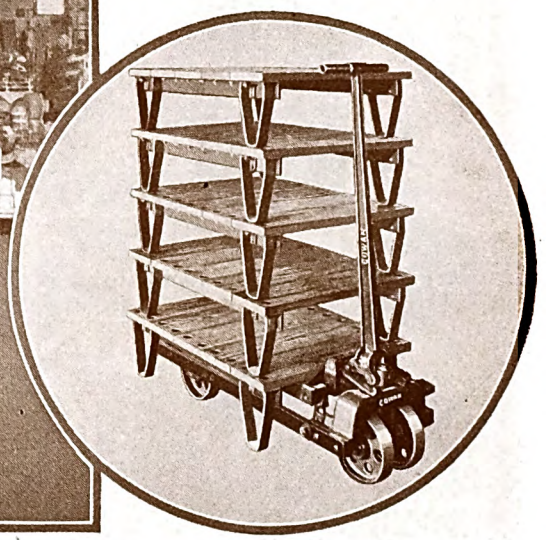
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ELIMINATE REHANDLING



Cowan Hand Lift Truck and skid platforms in the drill press department of a large manufacturing plant. Rehandling of incoming and outgoing materials is entirely eliminated.



Cowan Hand Lift Truck and Skid Platforms



Here, stored skins are quickly and easily moved by the Cowan System without rehandling.



Manual handling of these heavy loads would be slow, costly work. Quick, easy work here.



Through the Cowan System, even a girl can move loads weighing several thousand pounds.

This System has reduced material handling costs for thousands

In shop, warehouse, and factory—in businesses covering a range too wide for simple classification—the Cowan Hand Lift Truck and Skid System has effected remarkable material handling economies.

So broad has been the application of the Cowan System that it is quite probable that you, too, could save many thousands of dollars per year through adapting it to your own needs.

Why not see for yourself how the Cowan System has reduced handling costs in your particular line of business? Just write, briefly describing the goods or materials you handle, and we'll gladly send you information pertinent to your own problem.

COWAN TRUCK CO., 6 WATER ST., HOLYOKE, MASS.

Representatives in New York, Chicago, and other Principal Cities.

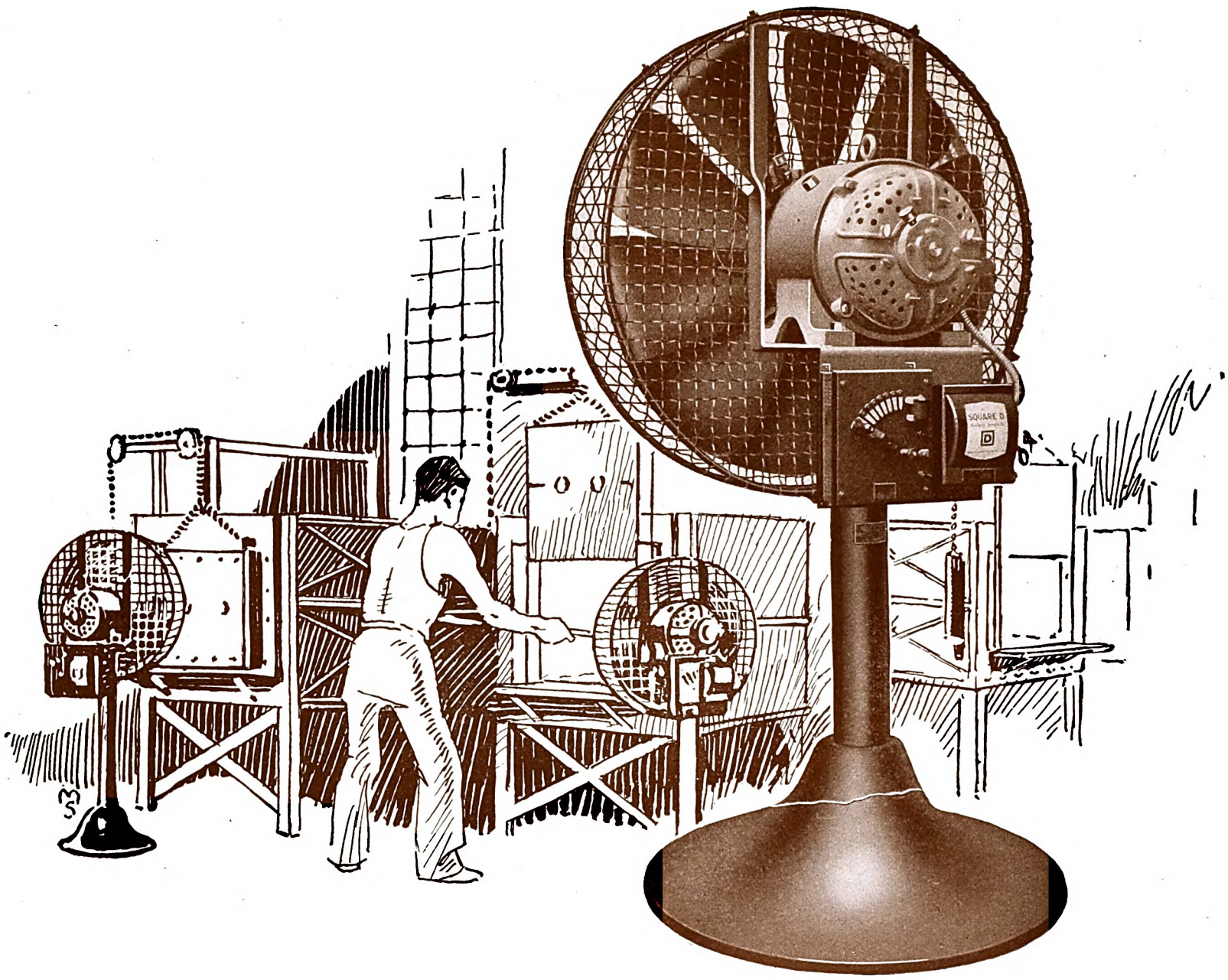
Largest Manufacturers of Complete Hand and Electric Industrial Truck Systems.

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COWAN INDUSTRIAL TRUCKS-TRACTORS



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Lower Your Labor Turnover on the "Man-Killing" Jobs

At the forges or the heat-treat furnaces, in the boiler room,—wherever men sweat, and swelter and "slow-up" long before the day is done:—there is where American Blower Man Cooling Fans pay big dividends.

They fan these burning places with currents of cool, fresh air. Men do more and better work and stay on the job because they work in comparative comfort. Production costs drop and so does labor turnover.

Man Cooling Fans can be set anywhere and the breeze controlled at will. Write for details and learn how many big concerns have found them to be both profitable and humane investments.

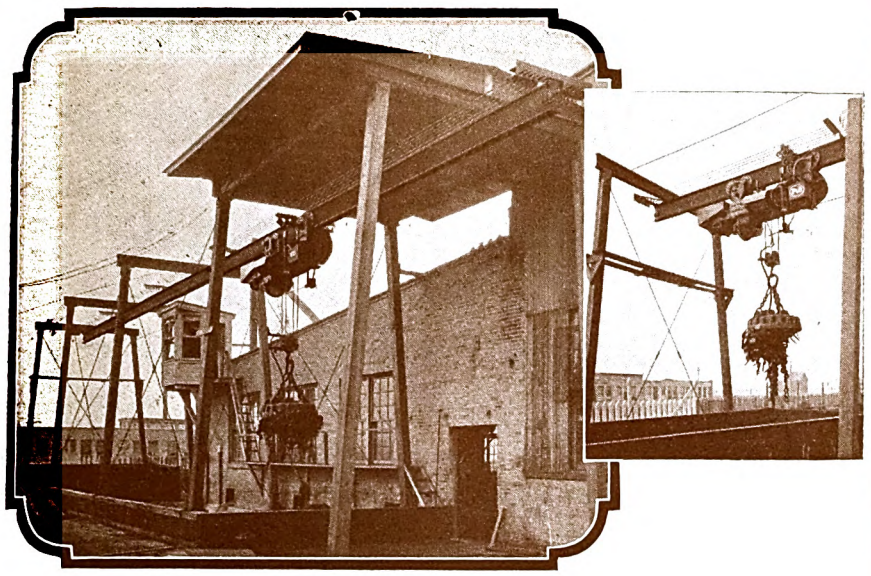
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BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO (294)

American Blower

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EXHAUSTERS · VENTILATING FANS · AIR WASHERS · BLOWERS · ENGINES
FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

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Caring for Scrap Is Economy

But Carry This Economy Further— Use Economical Handling Equipment

As the Michigan Manufacturer says: "Avoidable waste in America's industry is being gradually eliminated, millions of dollars are being saved, which a few years ago represented mountains of scrap. Scrap is being collected regularly,—stored, and shipped."

To get the greatest return out of this economical habit, —nothing should be wasted through expensive handling methods. P & H Hoists have proven big factors in reducing labor costs.

12 Men Released for Other Work

In one plant, a P & H 3-Ton Hoist does the work of loading cars with miscellaneous scrap, that formerly required 12 men with wheelbarrows. The loading of 50-Ton cars which took 5 hours with these 12 men, now takes but 2 hours and only the hoist operator is required.

Unloading is of course done with this same hoist,— 100 tons of steel plate are also unloaded in 4 to 5 hours— work that took all day and a gang of 12 to 15 men.

P & H Hoists can be installed inside or out. They may be put up in existing buildings, even where headroom prohibits the use of traveling cranes. They may also be used as feeders for cranes. They conserve floor aisle area by using overhead space otherwise not used, their service in expediting the handling of materials used in production, being of still more value than in scrap handling.

Crane and Hoist Division

PAWLING & HARNISCHFEGER CO.

Established in 1884

3850 National Ave., Milwaukee, Wis.

New York	Atlanta	Chicago	San Francisco
Pittsburgh	Portland	Philadelphia	Birmingham
Phoenix	Denver	Los Angeles	New Orleans
Seattle	St. Louis		

P&H HOISTS

(*Continued from page 61*)

tracted in this way.

It may interest the reader at this point to know in what industries the magnetic pulley has found application, and a few are enumerated:—

In the crushing of coal for strokers or powdered fuel, slag for ballast and concrete, salt, ore, glass cullet, abrasives, clay, etc., from which the tramp iron must be extracted to protect the crusher. Then again, the finer grinding of such materials as fertilizer, cocoa beans, sugar, talcum powder, grains and feeds, drugs and chemicals, carbon, rubber, etc., involves magnetic separation to protect the high speed grinders there employed.

Many pocket-knives, miners, lamps and similar pieces have been restored to their owners as has also an occasional can of beans or sardines which, during lunch time were set aside and overlooked, and which again appeared later on among extracted iron.

Under the second classification, magnetic concentration, magnetic separators find their greatest application in the concentration of magnetic iron ores which are scattered promiscuously and in great abundance in all parts of the world. The iron ore may exist as a highly magnetic ore, magnetite or as some of the higher oxides such as limonites and hematites. In the concentration of the former, a magnetic separator of medium intensity is employed, while in the case of the latter a more powerful high intensity separator is used.

Minerals always are associated with quartz, rock and silica. The latter are non-magnetic, and the preparation for the separator consists merely of crushing the ore as mined so that the iron and its non-magnetic associated gangue are more or less mechanically free from each other. The Magnetic Separator then extracts the magnetic portion, iron, and permits the non-magnetic portion, gangue, to pass on unaffected.

Magnetic separators for concentration may be of the dry or wet type. The former is employed when the ore does not require fine grinding. The latter is employed where fine grinding is necessary. The

(*Continued on page 65*)

Packed with Power for Production!

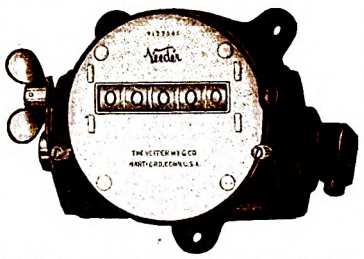
A Veeder Counter means more power to your machine—more pep to your machine operator—because those things "register" with you!

They register on the dial of a Veeder Counter, thru the obvious necessity of the operator making a *good* record; one that justifies good pay.

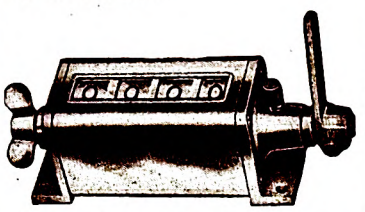
Work *moves* at the counter-equipped machine as it never moved before, because work and *production alone* moves the figures of the

Veeder COUNTER

Here's the big new development in a Punch Press Counter; a heavy-cased ratchet mechanism, immensely durable:



Built especially for recording the product of punch presses, metal stamping machines and other heavy-duty machinery. Strong stops limit the movement of the lever to 45 degrees or ⅛ turn, which registers one on the dial. The large, legible figures are easily read ten feet away. Counter is regularly furnished with five figure-wheels, and may be *set back to zero* by one turn of knob. Requires no special fixtures for attaching. Price $18.00.



The Revolution Set-Back Counter above records the output of any machine where a shaft-revolution indicates an operation.

Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figure-wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter, to record reciprocating movements as on presses, $11.50 (list)

FREE—This new 80-page booklet shows everything you could ask in a counter Ask for Copy.



The Veeder Mfg. Co.

63 Sargeant St. Hartford, Conn.

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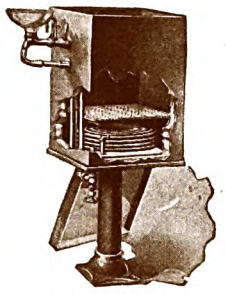


Does this happen in your plant?

THREE or four minutes wasted waiting for the water to get cold may not seem like a big item in itself. Its worst effect is that it presents an excellent excuse for loitering; so that these three or four minutes quickly multiply themselves into a cumulative loss that mounts into many dollars yearly.

Jewett *Square* Water Coolers not only obviate this time waste—but when installed in connection with the regular water system, hygienically provide an ample supply of refreshing, cooled drinking water that counteracts the tiring effect of hot weather, energizes your workers and definitely stimulates production.

Literature covering the economy of Jewett square design in detail—as well as the convenient, sanitary angle-flow bubbler and many other advantages—will gladly be mailed, together with prices upon request.



Uses 25% less ice

The Jewett Refrigerator Company
Established 1849
36 Chandler Street, Buffalo, N.Y.

JEWETT
SQUARE WATER COOLER



The fireproof, sanitary Marbleloid Floor of the Cafeteria of Studebaker Corporation at South Bend, Indiana.

THIS FLOORING USED EXTENSIVELY IN INDUSTRIAL BUILDINGS

Marbleloid is a fireproof, resilient, non-abrasive, non-slipping composition flooring material which does not require expensive upkeep and can be laid upon old or new wood or concrete floors. It is laid plastic and sets in a few hours into a seamless, smooth surfaced floor, good for a lifetime of service.

We have made a large number of installations of **Marbleloid Floors** in the offices, laboratories, hospitals, and restaurants, cafeterias, welfare rooms, work rooms, toilet and locker rooms, display rooms, etc., of industrial plants.

Marbleloid Flooring is manufactured and installed by our organization and guaranteed by us.

MARBLELOID
The Universal FLOORING for Modern Buildings

The coupon below will bring you additional facts- **without obligation.**

THE MARBLELOID CO., 467 Eighth Ave., New York

THE MARBLELOID COMPANY, New York City: Without obligating myself in any way, please submit tentative estimates on the cost of your product installed complete for our building.....
.....; below are the approximate areas involved.
Floor.....Sq. Ft. Sanitary Base.....Lineal Ft.
Wainscot.....Sq. Ft. I have checked the floor troubles we now have.

Our floors are
☐ New Concrete ☐ Cement Finish ☐ Wood
☐ Cracking ☐ Cold ☐ Slippery
☐ Dusting ☐ Splintering ☐ Unsanitary
☐ Noisy ☐ Rough ☐ Rotting

Name .....
Firm .....
Address.....
☐ Please send 32-page Illustrated Booklet

THE SIXTH SENSE OF INDUSTRY

Tycos Temperature Control



The SIX SENSES
Seeing
Feeling
Hearing
Smelling
√Tasting
and
Tycos Temperature Control

If Sense of "taste" sufficed the canning industry!

IF the fitness of cooked foods—its readiness for canning—were gauged simply by its taste, then ptomaine poisoning would be a scourge of the human race instead of a rare occurrence. The essence of successful food preservation is perfect cooking, to render the foods sterile, to kill the bacteria which cause decomposition. The essence of successful food sterilization is the accurate indicating, recording and controlling of temperatures. There is a well defined temperature point at which food should be sterilized to insure the bacteria being killed. This cannot be told by the sense of taste or sight or any of the familiar senses, but it can be, and is, absolutely assured by the "sixth sense" of industry—Temperature Control—made possible by *Tycos* Instruments.

Food in cans is sterilized by being heated by steam in pressure chambers. The canner cannot depend on the usual senses for knowledge that the contents have reached and are being held at the right temperature. Again the "sixth sense"—again the temperature control, made possible by *Tycos* Instruments, plays its part.

It is a tribute to the accuracy of *Tycos* Temperature Indicating, Recording and Controlling Instruments that the use of successfully canned goods is world wide today. It is significant that *Tycos* Instruments are regarded as the standard of accuracy in big canneries everywhere.

Is your business—your industry equipped with the "sixth sense" Certainly among the more than 8,000 different types of instruments in the *Tycos* Line are the ones exactly suited to your needs. *Tycos* Engineers are prepared to advise you in their installation. Literature on any type in which you are interested will be sent upon request.

Tycos in the Home

Tycos Wall Thermometers To help you maintain a temperature in your house conducive to good health.

Tycos Bath Thermometers To enable you to get the most good from your bath.

Tycos Hygrometer To enable you to keep the humidity of the atmosphere in your home correct at all times.

Tycos Stormoguide Forecasts the weather twenty-four hours ahead with dependable accuracy.

Tycos Quality Compasses To show you the right way in unfamiliar country.

Tycos Home Set Bake Oven Thermometer, Candy Theremometer, Sugar Meter. The secret of accurate results in cooking.

Tycos Office Thermometers An aid in promoting human efficiency.

Tycos Fever Thermometers A necessity in every home.

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above.



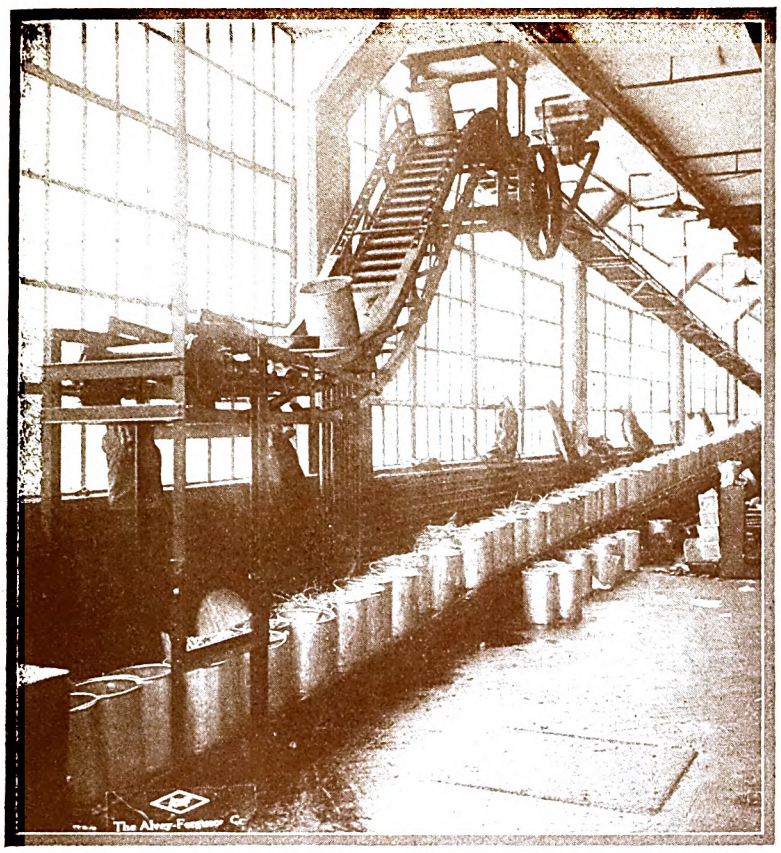
Taylor Instrument Companies

Main Office and Factory
Rochester, N. Y., U.S.A.
Canadian Plant
Tycos Building
Toronto, Canada

Tycos Temperature Instruments

INDICATING · RECORDING CONTROLLING

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How Continental Motors handle scrap steel at low cost

In the Continental Motors Corporation plant, scrap and turnings ride from the machines to the dumping tank and empty cans ride back on Alvey-Ferguson Gravity Conveyors. The transfer is made on an Alvey-Ferguson Automatic Inclined Elevator which boosts the cans to the overhead return gravity conveyor. And the only power required is a small motor which operates the lift. This system replaces a gang of truckers and uses less than half the floor space.

CONVEYING MACHINERY A F TRADE MARK

Conveyors

Aren't there many places in your plant where some such conveying system would speed up production and simplify traffic? No matter how different your plant may be, you can use Alvey-Ferguson Conveyors on every handling job at a substantial saving over hand trucking. Where standard machines are not practical, our Engineering Department will develop a special conveying system to suit your needs. We will gladly figure on the saving Alvey-Ferguson conveyors can make in your plant—at no obligation to you. Write us today.

Alvey-Ferguson Company, Inc.
Cincinnati · Ohio

(*Continued from page 63*)

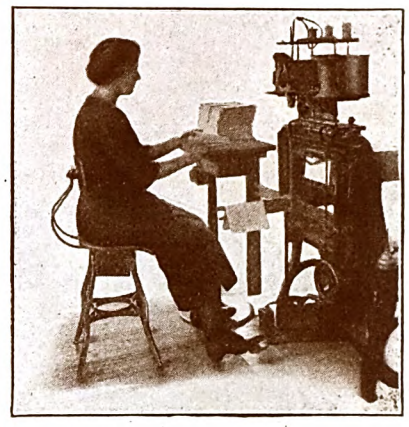
water assists the separator to overcome entanglement which may be promoted by the rush of the magnetic portion to the magnet.

In the zinc industry, where zinc sulphide and iron sulphide together are usually found associated with quartz and rock, and where neither the zinc sulphide, quartz and iron sulphide is magnetic, the last-named is made magnetic by subjecting it to an oxidizing roast. This roast does not affect the zinc sulphide or the quartz. The roasted ore is then passed through a separator which removes the roasted iron sulphide and allows the zinc and quartz to pass along unaffected. Further concentration by specific gravity methods (and which heretofore was not possible because the zinc sulphide and the iron sulphide approximated the same specific gravity) is now readily accomplished.

In every-day machine shop practice, brass, bronze or aluminum borings are produced. A bronze boring may have an outer casing of steel or iron, and in the process of machining the bronze and iron borings become intimately mixed. Bits of tools are broken off or worn off which also find their way into the borings, and these non-ferrous borings before re-melting and making into new castings, must have all the iron removed, otherwise small modules of iron will form in the casting and play havoc with the tools when the casting is machined. The machine most commonly employed and which will produce an iron-free non-ferrous boring and a clean bronze or brass free-iron product is what is known as the disc type separator. Here the mixed borings are fed into a hopper which insures an even feed upon an inclined shaker which passes beneath a magnet whose two pole pieces conform to the area of a circle.

A revolving disc of non-magnetic material, excepting the projecting lugs clearly shown, serves to deflect the magnetic particles in the borings when, in coming in close proximity to the large magnet are lifted upward. Two magnetic zones with the above construction are possible, so that a particle of

UHL STEEL PosturChairs



The illustration shows seat tilted forward which brings the back with it. Note the straight line spine and the properly located back support

This bindery operator is scientifically seated upon a Uhl Steel PosturChair, which increases her production, furnishes comfort during the entire day. And, her body is in the position health demands it should be.



The Uhl Steel PosturChair fits the body. The seated skeleton shows correct support. Note how the pelvic bones are relieved by the seat shape.

Fatigue is the thief of production. Incorrect support of the body breeds poor health. No employer would knowingly sanction impairment of health resulting from wrong chairs. And, increased production is being sought by every means. The Uhl Steel PosturChair is the answer.

PosturChairs have been designed in conjunction with, and are approved by the American Posture League of New York. Each chair bears label of approvel.

SPECIAL FEATURES: Made of cold rolled steel except seat and back which are wood. 10 heights each with 3" height adustment. Seat tilts forward or backward. Swivel seats when wanted. Durably built, neatly finished.



This is the No. 8150-V-WB, 28" high adjustable to 31". Nine other sizes. Note shape of seat. Sit in it and be convinced.

TRY ONE AT OUR RISK
If you are seeking more production and greater health protection for your workers, write us for a sample to try under your own conditions. It's free for two weeks use. Mention height needed. Descriptive pamphlets available.

THE TOLEDO METAL FURNITURE CO.
1606 Hastings St., Toledo, O.
Manufacturers of steel equipment for factories, stores, offices and schools.

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Suppose

You fire an employee — would his work be authentically recorded or counted—could you pay him off ?

If you had

ROOT COUNTERS

ingeniously installed you could.

They are the most versatile and dependable little helpers you can have around your plant.

We will gladly give you the benefit of our experience as to the best application in your shop.

We find new useful uses every day.

What would YOU like to KNOW?

ROOT
BRISTOL, CONN.

iron which passed through the first is surely gotten by the second. The shaking and tumbling effect on the material when it travels down the shaker, insures a thorough disentanglement of the mixture.

In grey iron, steel or malleable foundries, there is a tremendous waste of iron going out to the dump, unless a magnetic separator is employed to reclaim this iron. For this purpose a revolving screen with a magnet at its lower end is used. The refuse consisting of sand, brick-bats, burnt cores, spillings, gaggers, risers, etc., is first screened and the sand so obtained is fit for re-use. The pieces of iron with the coarser value, less material, travels to the lower end of the screen where it comes in contact with a magnet of semi-circular shape and this attracts the iron firmly to it, and by virtue of the revolving of the screen carries this iron upward and around until it is automatically carried outside the influence of the magnet where it drops into a chute to collect it. The valueless material which has reached the end of the screen with the iron takes its natural course for discharge.

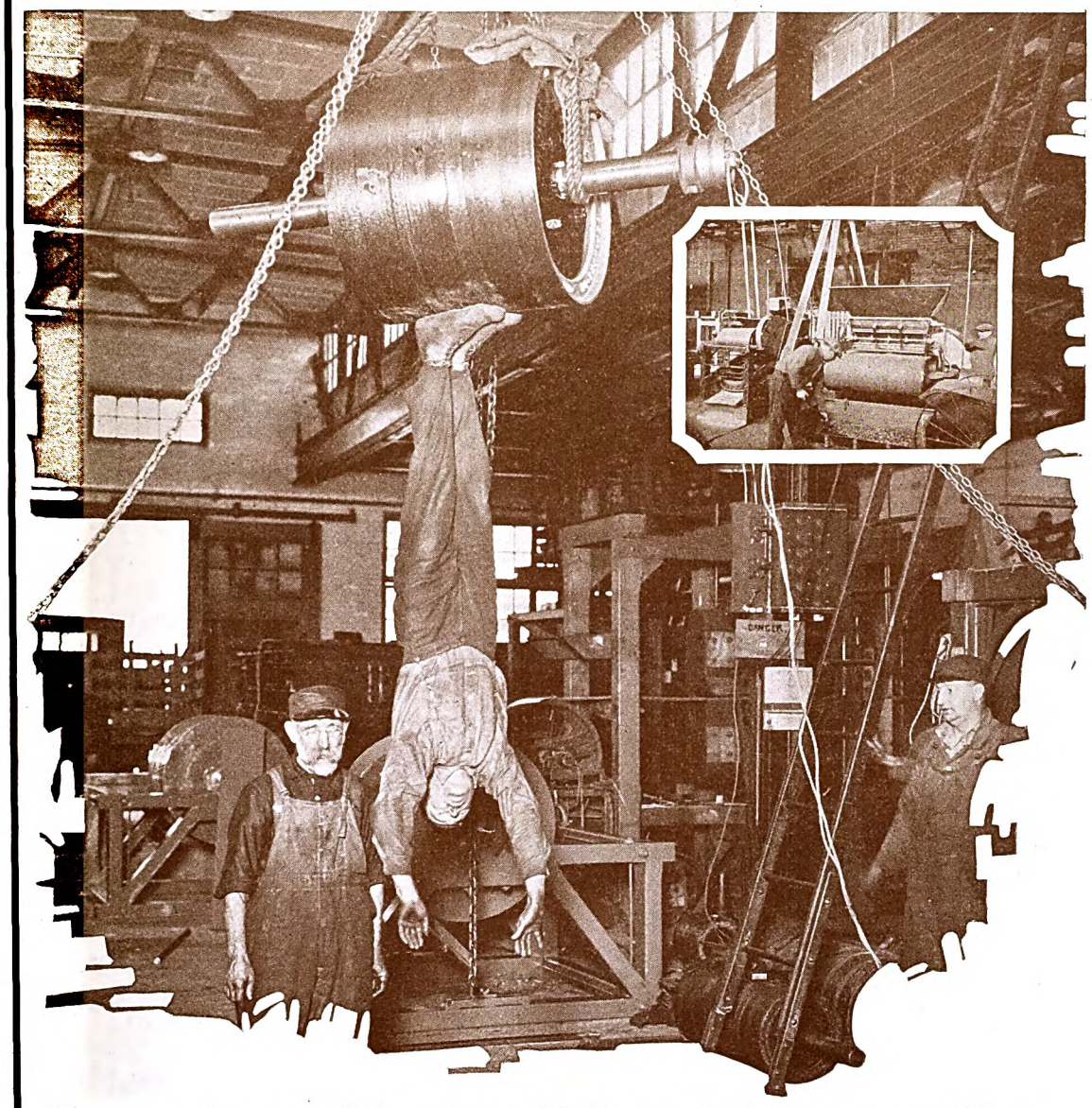
Under the third classification—the removal of minute particles from a finished product—the following applications are of interest. In the preparation of food stuffs whether for human beings or beasts, impurities must be eliminated. Most food stuffs in their preparation are ground and from that process more or less iron finds its way into the finished product. The grinding surfaces themselves wear off or a piece of iron may find its way into the grinder only to be ground up into many small bits. Then again in the final bagging or packing of the food stuff, pieces of iron are introduced carelessly or unavoidably. Many cases are on record where cows and hogs have died from the effects of eating iron ground up with the food material. Actual figures show that in 1922 alone 25,000 heads of cattle died from this cause. The death of so many hogs by what has presumably been called "hog cholera" has been diagnosed as coming from iron in the food, firmly and finally lodging in the digestive organs. In like manner, iron in a dainty bon bon or in mademoiselle's choicest face powder is an undesirable element.

The iron which nature has so promiscuously scattered among her sands and clays must be removed before the ceramist or potter can use it for making his china and porcelain. The blue specks and minute blisters found on inferior ware is iron.

While a few of the applications in the three general classifications outlined above have been enumerated, there are many others of a novel and interesting application to be cited. Among these are the removal of iron from blast furnace slag, where the iron is reclaimed and the slag for use as, ballast, portland cement, etc., is materially improved. In paper and pulp mills the iron is removed from the pulp to improve the quality of the paper. In glass plants iron is very deleterious. Clear crystal glass is impossible with iron present in the ingredients. Tin cans and other iron are worth reclaiming by magnetic separation from the garbage as is also plated silver ware from restaurant refuse. The sorting of brass hooks and eyes from similar ones made of iron is a magnetic separator problem as is also the removal of buckles, nails, etc., from scrap rubber.

The U. S. Bureau of Standards and technical Universities employ separators for research and laboratory problems. In the abrasive industry where either the natural or manufactured abrasive is employed, iron associated with it detracts from its abrasive qualities. In short, wherever there exists a mixture of magnetic and non-magnetic material, a magnetic separator of standard or special design. should be employed.

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Learn how this new industrial force will—

1—Protect crushing and grinding equipment
2—Cut the cost of sorting and separating operations
3—Raise the quality of many manufactured products

A natural force, magnetism, has in the past few years gained for itself recognition as a powerful industrial servant. As applied in Dings "High Intensity" Magnetic Separators, it is serving industry in many money making ways.

Dings Magnetic Pulleys are protecting crushing and grinding equipment from damage by tramp iron. Freedom from crusher breakdown, from repair costs and from interrupted production is assured. The strength of a Dings Magnetic Pulley is shown by the illustration above; the pulley is holding the man only by its attraction for the iron in his shoes.

Wherever materials of even slight magnetic susceptibilities are to be sorted or separated, Dings Separators soon pay for themselves. Dings Magnetic Separators are used by the Frances Hook & Eye Co. to separate brass and iron hooks and eyes—by the Winchester Repeating Arms Co. to sort out shells with and without steel caps—by the Crown Cork and Seal Co. to remove crown caps from cork—by the National Screw and Tack Co. to extract tacks from sawdust—by an ever increasing number of manufacturers in a constantly widening list of miscellaneous uses as suggested by the listing opposite.

In hundreds of manufactured products the presence of iron is injurious—in drugs, chemicals, food products, and in the products listed opposite. Dings Magnetic Separators of the simple pulley type or of more highly specialized types remove this iron and raise selling prices and demand.

Don't you want to know how Dings Magnetic Separation can make money for you? Then send the coupon below to Dings engineers—specialists in Magnetic separation with a wealth of experience gained in installing over 3500 machines. Send the coupon to the Dings Magnetic Separator Co., 1404 Smith St., Milwaukee, for the bulletins, for a visit from a Dings engineer, or for directions for sending a sample for magnetic analysis at only a nominal laboratory fee.

See phone book for branches in New York, Denver, Richmond, Detroit, Chicago, Pittsburgh, Cleveland, St. Louis, El Paso, Birmingham, Cincinnati, Los Angeles, Portland, Ore.

Dings High Intensity MAGNETIC SEPARATION

Know the wide range:

In mines, mills and smelters—
Dings Separators protect crushers from damage by tramp iron. Highly specialized types refine and reduce minerals and ores at low costs and with high recoveries.

In milling industry—
Dings Separators extract tramp iron from conveyed grain, preventing grain dust explosions and fires. They remove small particles of iron from feed as it is sacked.

In iron foundries—
Dings Separators reclaim iron, coke and moulding sand from refuse and dump piles.

In non-ferrous foundries—
Dings Separators free brass and other non-ferrous metals of iron. In the inset opposite, separators at the Michigan Smelting and Refining Co. are removing iron from brass borings. Twelve machines have been installed here in eleven years.

In rubber reclaiming—
Dings Separators remove studs, chain links and other bits of iron from old rubber before it is fed to the rolls for grinding.

In glass plants—
Dings Separators remove iron from cullet more cheaply than hand pickers. They extract iron from glass sands. Iron in glass causes discoloration.

In potteries—
Dings Separators remove iron from pottery slip, assuring freedom from black specks in the china.

In rock crushing plants—
Dings Separators protect crushers from the danger of breakage from tramp iron. This danger is ever present in quarries and in the manufacture of cement and gypsum.

In power plants—
Dings Separators, where coal is crushed or where fuel is pulverized, protect the crushing equipment.

In cotton seed mills—
Dings Separators protect linters and hullers by removing stray iron from cotton.

In garbage reclaiming—
Dings Separators remove cans and other scrap from the refuse.

In miscellaneous manufacturing—
Dings Separators at some stage of production, remove iron where iron is injurious. The list of products in this classification is almost endless, and includes: drugs, chemicals, sugar, salt, food products of all kinds, cattle and poultry foods, batteries, carbon, ammunition, chicory, crucible clay, gas mantels, copra, vegetable oil, chocolate and cocoa, paper, pulp, ink, abrasives, glue, distillery and brewery products, talc, celluloid, starch, asbestos.

In laboratories—
Dings Separators are used by universities, commercial laboratories, consulting engineers, the Navy, U. S. Bureau of Mines and U. S. Arsenals.

Mail this coupon for bulletins →

I am interested in magnetic separation for;

☐ Please send the bulletin ☐ Have an engineer call
☐ Send directions for sending sample for analysis

Firm .....
Address .....
My Name .....

Ind. Ill. 6-23.

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The Latest Answer to High Fuel Costs

(*Continued from page 20*)

rounded with air enough to burn it completely. Combustion takes place instantaneously when the heated particles are heated to the temperature required. A striking example of the rapidity of the burning of powdered coal, as compared with lump coal, is found in the coal-dust explosions which sometimes take place in mines. Frequently the atmosphere of the mine becomes so laden with the very fine coal dust that the mere spark from an electric trolley wire, or other source, will explode the mixture, causing serious damage to life and property. The burning of powdered coal is, therefore, more in the nature of an explosion, due to the rapid combustion of the fuel and the resultant sudden liberation of a large volume of gas.

The fine particles of coal dust burn completely with less excess air supply than does lump coal, since each particle is so small that the air immediately surrounding it is practically sufficient for the combustion of its entire mass. With pulverized coal, therefore, the air supplied to the furnace is very little in excess of what is actually needed for combustion and the cooling effect of the excess air is much less than with the ordinary coal-fired furnace. The furnace temperatures are, consequently, much higher, and the efficiency and economy are greater. In some cases this amounts to 15 per cent. saving in the annual coal bill.

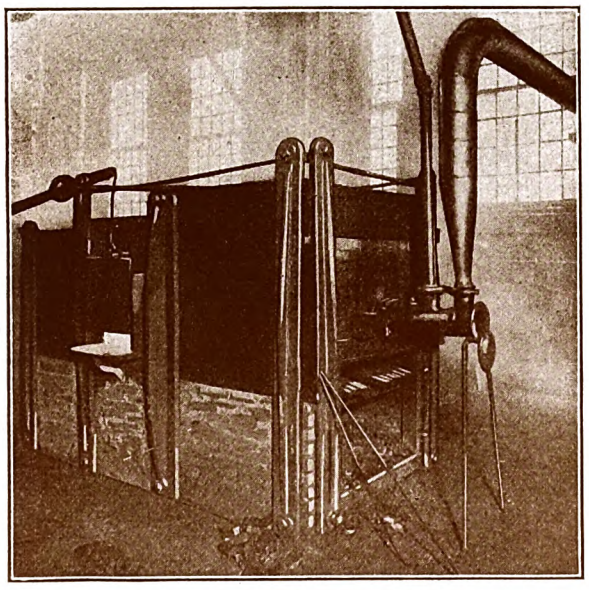
Because of the rapidity of combustion of pulverized coal and of the ability to liberate a large quantity of heat energy in a short space of time, such installations are able to accommodate sudden peak loads with comparative ease, maintaining a fairly constant steam pressure in spite of sudden and widely varying steam demands. The assurance of constant steam pressure at all times has in many cases been responsible for actual appreciable increase in plant production.

The rapid and complete combustion, coupled with recent improvements in furnace design, has resulted in a smokeless operation, even at high overloads, which has been more than successful in meeting the requirements of the most stringent smoke ordinances. Smoke, in itself, is caused when unburned furnace gases meet the much cooler boiler tubes, are condensed and form fine soot particles, which pass out the stack. In pulverized coal installations, there is seldom more than a faint gray haze issuing from the stack, consisting largely of fine ash particles, which have found their way through the setting.

Naturally, the problem of ash disposal is quite different from that of the ordinary plant. When pulverized coal burns, the ash is melted by the intense heat into a liquid spray, which trickles down the furnace lining and falls into the ash pit. Slagging is sometimes prevented by allowing the ash to fall upon a suitable water screen, which chills the vitreous slag, rendering it

VERONA TOOLWORKS PITTSBURGH

Making High Grade Forged Tools with Pulverized Coal



Holbeck System Fires Small Forge Furnace at Verona Tool Works

The Verona Tool Works, Pittsburgh, are satisfied with the results obtained during four years' use of

Holbeck Pulverized Coal System

They have no difficulty in maintaining their high standard of quality in the Railroad Tools which they manufacture.

Their Production Departments are free from bins, motors, or complicated apparatus of any kind.

There is no method as satisfactory as the Holbeck System for serving a large number of small furnaces.

PULVERIZED COAL EQUIPMENT

Write for Bulletin No. 600

The Bonnot Company

CANTON, OHIO

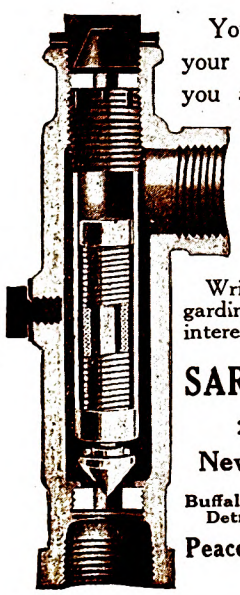
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A BIG SAVING HERE

You can economize in power and equipment by installing the Steam Trap Sarco.

You can then save one-third the price it would have cost to buy ordinary traps. You can eliminate the expense of building platforms and digging pits—for the Sarco is screwed right into the pipe line. And you can effect a big saving in fuel because, on account of its small cost, you will be able to trap every point that requires trapping, thus draining off all condensate as soon as it forms.

Furthermore Sarco Traps will cut down repair bills, for they have but five parts compared with as many as forty-three in some traps. Consequently, there are fewer parts to carry in stock—fewer parts to wear out and need replacement.



You can safeguard your judgment until you are sure that the Sarco will do as claimed, as we will ship same on 30 days' free trial.

Write for particulars regarding free trial offer and interesting booklet R-31.

SARCO CO., INC.

236 Broadway

New York City

Buffalo Chicago Cleveland
Detroit Philadelphia

Peacock Bros., Limited
Montreal

STEAM TRAP SARCO

light and brittle, and preventing it from fusing together into a solid mass.

Nearly one-fourth of the ash is collected in the ash pit, from which it may be removed by hand or by a pneumatic ejector. Ash is also deposited in pockets provided for the purpose in the boiler setting, from which it is also removed pneumatically. The balance, a small quantity, deposits in the flue connections or passes out the stack.

A lump of coal, in passing through a typical pulverized fuel-burning plant, drops from the coal car into a crusher and is elevated to storage bins, from which it feeds into the pulverizer mill. In one type of design, storage hoppers are provided at the point where the pulverized coal is to be burned and the coal dust and air are intimately mixed at this point, just before they enter the furnace through the burner.

In another type, the dust is fed to a fan of suitable size and speed and is blown through large pipes into the furnace. In this system air heavily charged with coal dust is circulated through continuous pipe lines to the furnace branches. The unused fuel returns to the initial point to be again blown through the line until used.

The "unit system" pulverizes the coal at or near the point where it is to be used and delivers it directly to the furnace by means of a blower, which may be an integral part of the equipment. In this type air is admitted in conjunction with the fuel.

Each system has its advantages and it is not the purpose of this article to discuss the relative merits of each but, rather, to point out how the use of such systems as described has resulted in the realization of substantial operating economies.

Accurate records and comprehensive tests have recently been made on the pulverized fuel-burning equipment of a large central station in the Middle West, consisting of eight 1300-horsepower boilers. Considerable interest was directed toward this plant with a view to ascertaining the extent of the economy that was possible. In the normal operation of the boilers, peak loads



For the man beyond the campus

FOURTEEN YEARS ago Joseph French Johnson, who was, and is, Dean of the School of Commerce, Accounts and Finance of New York University, found himself faced with a problem to which there was no satisfactory answer.

He was constantly in receipt of letters from business men, many of them occupying places of executive responsibility. The letters asked such questions as these:

"What books shall I read?"
"Can you lay out for me a course in business economics?"
"How can I broaden my knowledge of salesmanship, and accounting, and factory management, advertising and corporation finance?"

Those were pioneer days in the teaching of Business. Dean Johnson, wanting to help, yet feeling keenly the lack of suitable facilities, conceived the plan of a faculty including both college teachers and business men, and a Course so arranged that any man might follow it effectively in his own home.

Thus began the Alexander Hamilton Institute. Dean Johnson has continued as its President; its Advisory Council includes these men: JOSEPH FRENCH JOHNSON, Dean of the New York University School of Commerce; GENERAL COLEMAN DUPONT, the well-known business executive; PERCY H. JOHNSTON, President of the Chemical National Bank of New York; DEXTER S. KIMBALL, Dean of the Engineering Colleges, Cornell University; JOHN HAYS HAMMOND, the eminent engineer; FREDERICK H. HURDMAN, Certified Public Accountant; JEREMIAH W. JENKS, the statistician and economist.

To young men of college age, the Institute says: "Matriculate at a college or university if you possibly can; there is no substitute for the teacher." To older men, the universities and colleges, in turn, are constantly recommending the Modern Business Course of the Institute.

THESE COLLEGES and universities, and 80 others, have used parts of the Alexander Hamilton Institute Course in their classroom work.

Amherst College
Boston University
Brown University
Bucknell University
College of the City of New York
Columbia University
Cornell University
Dartmouth College
Georgetown University
Georgia School of Technology
Lafayette College
Massachusetts Institute of Technology
McGill College
New York University
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Ohio State University
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University of Alabama
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University of Chicago
University of Michigan
University of Indiana
University of Pittsburgh
University of Texas
Vanderbilt University
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Washington and Lee University
Williams College
Yale University

It is a Course for the man beyond the campus; the man who is already in business and cannot leave; the man who wants to supplement his college education; the man who has never been to college. If you are such a man, may we send you, without obligation, a copy of "Forging Ahead in Business"? It tells how 200,000 men have profited by a business training founded upon university principles, and conducted in accordance with university ideals.

ALEXANDER HAMILTON INSTITUTE
807 Astor Place, New York City

Send me "Forging Ahead in Business" which I may keep without obligation.

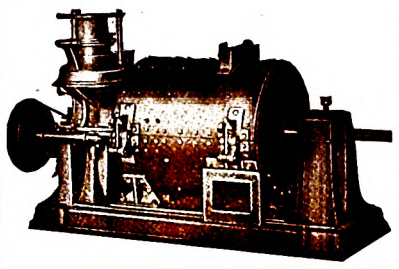
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Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY

165 Broadway
New York

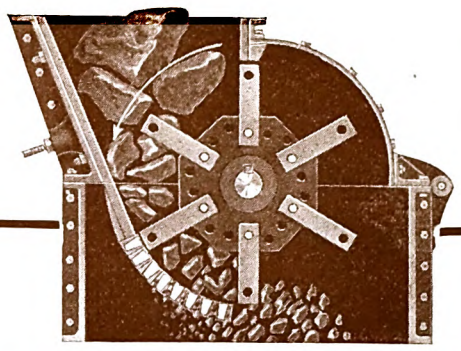
as high as 225 to 250 per cent. of rating were experienced. The records and data collected showed that the heat actually absorbed by the boilers ran as high as 82 to 86 per cent. of the total heat in the coal. Such a performance is unheard-of in ordinary coal-fired plants, where maximum average efficiencies (including banking periods) of 75 per cent. are considered high.

One of the engineers intimately connected with this work had occasion to remark, in commenting upon the installation, "Not the least of the advantages is the quietness and cleanliness of the operation, the absence of dirt and clutter inseparable from the handling of loose coal in the fire room. There is no fuel visible, no objectionable dust and none of the roar attending the use of some of the methods of firing liquid and gaseous fuels, while the station has all the neatness of an oil-fired plant."

Another plant, where four 500-horsepower Wickes boilers are equipped with pulverized coal burners, operates at 175 pounds pressure, 100 degrees superheat and from 150 per cent. to 200 per cent. of rating continuously. This installation is not much more than a year old, but, although practically new, the management and engineering staff have already expressed general satisfaction with its operation. In fact, they have gone a step further and stated it as their opinion that the greater cost of the installation, as compared with a stoker-fired plant, has been more than offset by the higher operating economies that are possible and by the ease and flexibility of operation. To date no trouble has been experienced with the arches, furnaces and brickwork, showing that correct and improved designs have made possible high operating economies, without excessive maintenance costs.

In a certain 600-horsepower plant, again in the Middle West, municipal smoke ordinances made vital changes necessary in the design and arrangement of the plant. After a thorough consideration of all the problems involved, powdered coal burners were selected as the logical so-

(*Continued on page 75*)



GRUENDLER Swing Hammer Crushers & Pulverizers is an original design adapted to more Crushing, Pulverizing, Cutting problems than any other known type in the World.

The Old and Sure method of Breaking, Crushing, Pulverizing, Cutting with hammer, knife or hatchet is applied in a mechanical way many thousand times multiplied, thereby giving you many thousand single hammer or cutting blows per minute in a small machine requiring very small floor space.

Stop and think of the old primitive method using thousands of men for little work and scientific method of **GRUENDLER** Crushers which eliminates all labor.

A FEW OF THE MANY PROBLEMS THAT GRUENDLER HAS SOLVED ARE:-

Crushing Coal for chain Grate or Stokers, for Cokeing, for powdered Fuel, for crushing your old Fire brick, for patching your furnace linings.

Put your Crushing and Grinding Problems up to us.

GRUENDLER

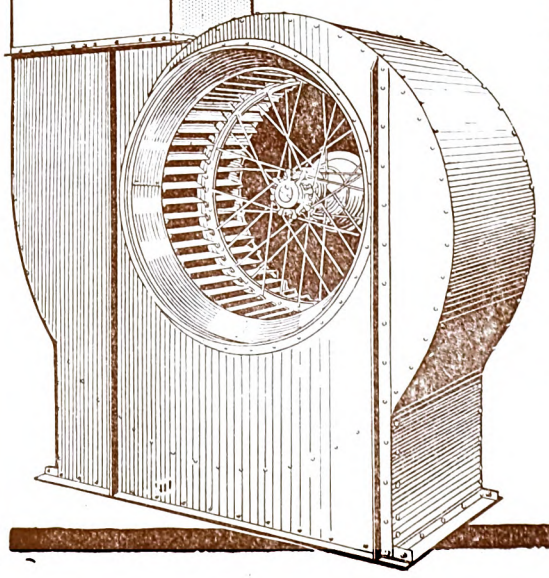
Gruendler Patent Crusher & Pulverizer Co.,
968 First St. St. Louis, Mo. U. S. A.

EFFICIENT VENTILATION

Can be obtained only through the use of equipment designed to meet the specific requirements for which it is intended.

Bayley PLEXIFORM FANS

are made in a variety of capacities from 300 to 300,000 cubic feet per minute. They are designed especially with a view of handling a maximum volume of air from a minimum of space and power requirement. Their efficiency as proved by installations in thousands of the largest industrial, public, school, theatre and office buildings, makes them prime favorites with architects, engineers and owners.



Write for Catalog

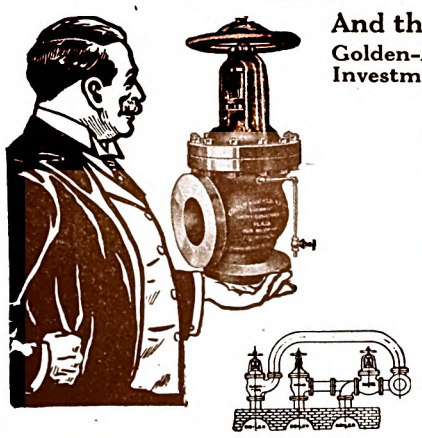
BAYLEY MFG. CO.
DEPT. (P)
MILWAUKEE, WIS.

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Why did the large Steel Corps. Install 4100 GOLDEN ANDERSON

Life and Property Insurance Valves?

"There Must Be a Good Reason"



And there certainly is

Golden-Anderson Valves are a Gilt-edged Investment in safety.

"No Shut-Down When a Boiler Tube Ruptures"

"No Explosion When a Steam Pipe Bursts"

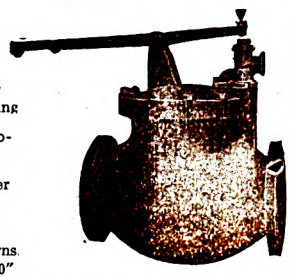
DOUBLE EXTRA HEAVE VALVES

„Every Valve Sold with a Postive Guarantee."

1. They will cut off a boiler instantly when a boiler tube bursts.
2. They will prevent live steam from entering a cold boiler, thus insuring safety to workmen.
3. They instantly shut off the steam from all boilers when a pipe breaks.
4. They can be opened or closed by hand in the same manner as ordinary gate or globe valves when fitted with the patented safety latch.
5. Double cushioning prevents absolutely all pounding, or chattering.
6. Automatically equalize the pressure between all boilers.
7. Are equipped with double Corliss Dash Pot that cushions it opening and closing.
8. Cannot pound, spin, stick or chatter.
9. Every valve sold with a positive guarantee.
10. Safeguard the men and safeguard the property.

GOLDEN-ANDERSON

Pat. Automatic Cushioned Stand Pipe Valves



Especially adapted for coke quenching

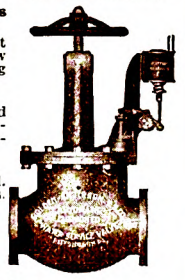
No metal-to-metal seats

Air and water cushioned

Angle and Globe patterns. Sizes 3" to 30"

GOLDEN-ANDERSON

Cushioned Electric Water Service Valves For Fire Service



No waste of current as it is only on solenoid a few seconds on either opening or closing of valve.

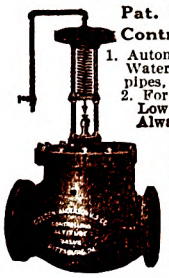
May be closed and opened from remote points electrically; also hand operated.

Air and water cushioned. No metal-to-metal seats. Virtually indestructible.

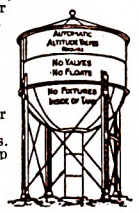
Sizes to 30 in.

GOLDEN-ANDERSON

Pat. Cushioned Automatic Controlling Altitude Valves



1. Automatically Maintain uniform Water Levels in Tanks, Standpipes, Reservoirs, etc.
2. For High or Low Pressure. **Always** Dependable.
3. No Floats or Fixtures used.
4. No Water Hammer or Shocks.
5. Sizes up to 30 in.



GOLDEN-ANDERSON

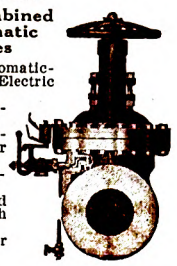
Pat. Automatic Cushioned Water Pressure Regulating Valves



1. Maintain a constant reduced pressure regardless of fluctuations on high pressure side.
2. Perfectly Cushioned by water and air. No metal-to-metal seats.
3. The best valve made for maintaining a constant low pressure where consumption is continuous.
4. Operates quickly or slowly as required—No attention necessary.
5. Positively no hammering or sticking. Sizes to 24 in.

GOLDEN-ANDERSON

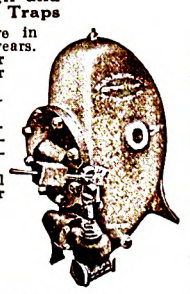
Pat. Cushioned Combined Throttle and Automatic Engine Stop Valves



1. Operate 3 ways: Automatically, by Hand, or by Electric switch.
2. Prevent Fly-wheel Explosions.
3. "Double Corliss" Cushioned—No Pounding or Sticking.
4. Contains No Tight Fitting Parts.
5. Furnished in Angle and Globe Patterns for High or Low Pressures.
6. "Always Ready for Service."

GOLDEN-ANDERSON

Patent Automatic High and Low Pressure Steam Traps



1. The first new departure in steam trap design in years.
2. 50 to 100% greater capacity than other traps of similar sizes. Full area through discharge valve.
4. Extra Heavy Throughout—Very Durable—Will last a lifetime—and **Always Works.**
5. Furnished Semi-Steel and Cast Steel for Superheat.

GOLDEN-ANDERSON

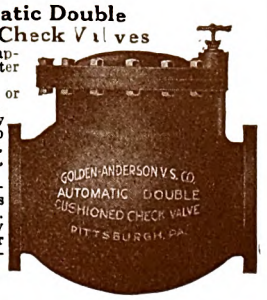
Pat. Automatic Steam Pressure Reducing Valves



1. Maintain a constant reduced pressure.
2. Thoroughly cushioned.
3. No hammering, chattering or sticking.
4. No auxiliary valves or small by-passes to clog up.
5. No wire drawing.
6. Only one adjustment from the outside.
7. Double extra heavy throughout—practically indestructible.

GOLDEN-ANDERSON

Pat. Automatic Double Cushioned Check Valves

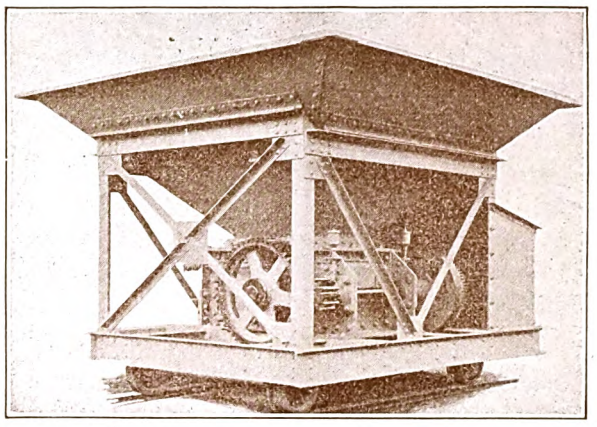


1. Especially adapted for Water Service.
2. For High or Low Pressure.
3. Thoroughly Cushioned. No Chattering, Hammering, or sticking.
4. Globe or Angle Patterns up to 30 in.
5. Especially adapted for hydraulic elevator service.

Golden-Anderson Valve Specialty Co.

1306 Fulton Building **Pittsburgh, Pa.**

"PENNSYLVANIA" ARMORFRAME SINGLE ROLL COAL CRUSHER.



In a recent Paper Mill installation, the "Pennsylvania" ARMORFRAME mounted on a Steel car receives the coal in its Steel Hopper direct from the storage pile by means of locomotive grabbucket Crane. The car runs on the Power House roof and delivers the coal to the stoker hoppers by gravity. The Crusher is motor driven.

This is the simplest method of coal handling and uniform preparation where local conditions permit its use.

Tramp Iron has no terrors for the "Pennsylvania" ARMORFRAME with its massive steel construction and Triple Tramp Iron Protection.

"Pennsylvania" Coal Preparation Machinery includes Bradford Breakers for crushing, cleaning and sizing large tonnages at Mines, Gas Works and Central Stations; "Pennsylvania" Hammer Crushers for By-Product Coke Plants and preliminary to pulverizing, and "Pennsylvania" ARMORFRAMES for Mines and Industrial Power Plants.

Outline your problems when sending for Coal Preparation Bulletin No. 6001.

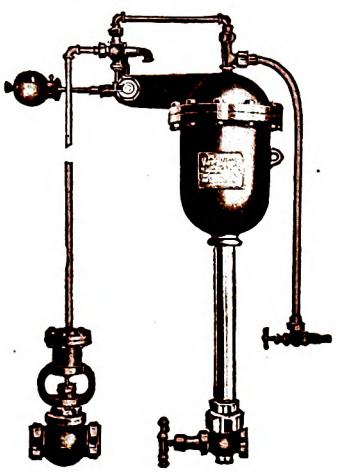
PENNSYLVANIA CRUSHER COMPANY

1320-1325 Stephen Girard Bldg.
PHILADELPHIA, PA.

What Real Insurance have you in your plant?

The best equipped plants have the best efficiencies

VIGILANT Feed Water Regulator



What if an explosion did destroy your power house? It's insured, isn't it? But would the insurance money be enough to build you a new plant? And what would become of your business meanwhile? And would your men, once laid off, wait around for you to start up again? No, certainly not. Any explosion that could wreck your power house, would probably wreck your business as well.

Act Now

You can do everything in your power to safeguard your plant against boiler explosion due to low water by installing Vigilant Regulators.

Their operation depends on gravity—always positive. No expansion tubes to buckle or to get out of line. No diaphragms to crack. No floats to fail. You can actually see it work. The movement of the outside weighted levers gives evidence of its operation.

Get our engineers' recommendation. No obligation.

Write for the catalog today.

The Chaplin Fulton Mfg. Co.,

28-36 Penn Avenue
Pittsburgh, Penna.

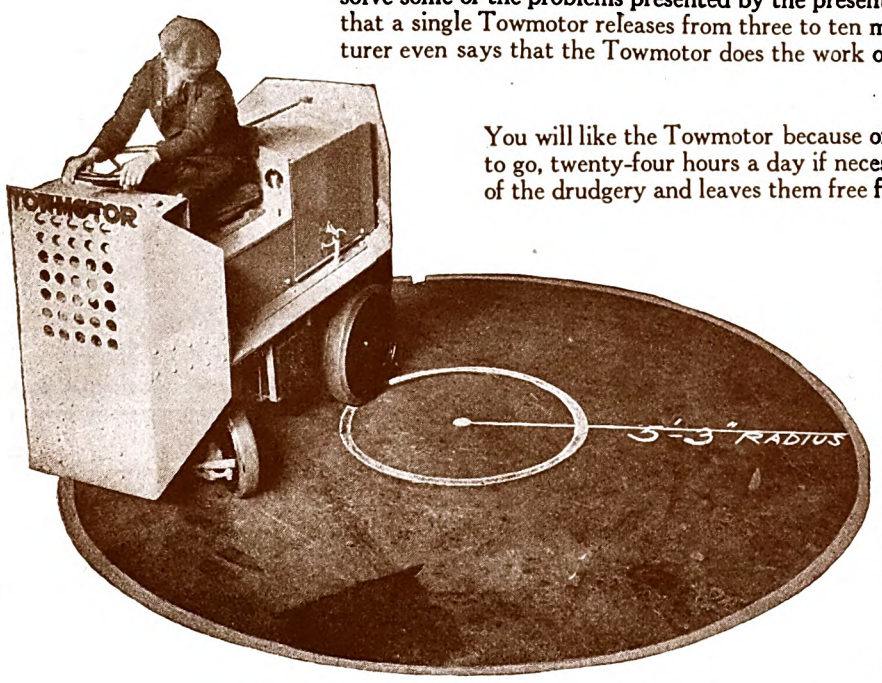
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Chase Metal Works, Waterbury, Connecticut

HOW MANY MEN WOULD IT TAKE TO MOVE THIS LOAD WITH HAND TRUCKS? HOW LONG WOULD IT TAKE? AT PRESENT LABOR PRICES, HOW MUCH WOULD IT COST?

With a Towmotor you can do it quicker, easier and cheaper. With Towmotor Haulage Equipment, you can solve some of the problems presented by the present shortage and consequent high cost of labor. Users tell us that a single Towmotor releases from three to ten men for other work—one Cleveland automobile manufacturer even says that the Towmotor does the work of fifty men.



Model C Towmotor, with 5 foot 3 inch turning radius. It gets into—and out of—the corners.

You will like the Towmotor because of the way it does its work, and because it is always ready to go, twenty-four hours a day if necessary. Your workmen will like it because it relieves them of the drudgery and leaves them free for more congenial work.

Have you seen the newest Towmotor, the model C? It is smaller than the other models, gets through narrower aisles, turns shorter corners and gets out of tighter places. The sturdiness and high grade construction that have distinguished Towmotors, have been retained in this model, which shows every indication of becoming just as popular as its prede cessors.

Perhaps a Towmotor (or a fleet of Towmotors) is just what you need, just what you have been looking for. Full details and any information we can give you are yours for the asking.

THE TOWMOTOR COMPANY
1226 East 152d St., Cleveland, Ohio.



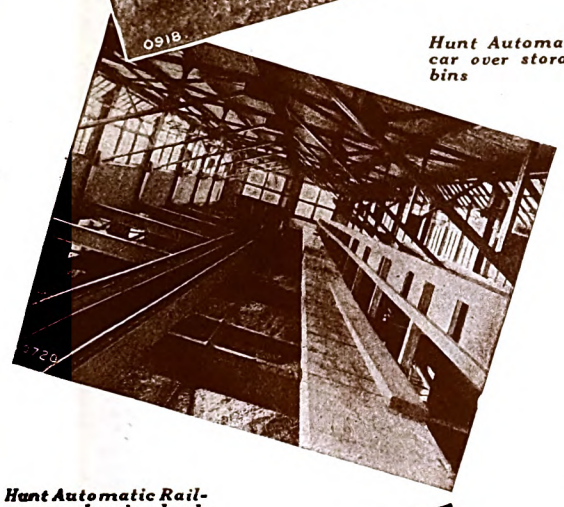
American Dock Co., New York.

THE TOWMOTOR

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Hunt Automatic Railway car dumping load in yard



Hunt Automatic car over storage bins



Hunt Automatic Railway car showing loading end

45 Years Perfect Service

with only minor repairs

The Hunt Automatic Railway shown in the top picture, has handled bulk material used in a big Sewer Pipe plant for over 45 years, requiring in all that time only the replacement of *the cable and one pulley block*.

This, and other examples of veteran service covering periods of ten years and upward, is sufficient proof of the staunchness of this rugged type of Hunt Cost Cutting Equipment. But there are other features to recommend its adoption, especially where economy in ground space is essential; also where the saving of time, labor and money is desired, or necessary.

HUNT AUTOMATIC RAILWAY

Absolutely self-acting from time of starting with load, until it returns empty and ready for another load.

The cost of operating is confined to *one* man's wages. The workman at the loading end fills car and starts it down track,—but does not accompany it—it automatically dumps the load at any desired point and returns under action of gravity.

Coal can be accurately weighed without delay or extra expense, by placing platform scales at loading end, (in the tracks). The loader weighs the car and while car is running down the tracks, enters the weight in the tally book.

Track and supports can be easily erected; the whole system is free from any confusion of switches, turnouts, ropes, etc. No loose pieces to get stolen or lost; nothing to take care of or put away. Cars left just as used and are ready for work at any time. Good for at least 10 years service without repairs.

Can also be used for transporting sand, phosphate rock, clay, ores, limestone, salt, cement and similar bulk materials from railroad cars and vessels to storage bins or pockets.

The Efficiency, Economy and Safety of the Hunt Automatic Railway is fully described in Booklet 20-3

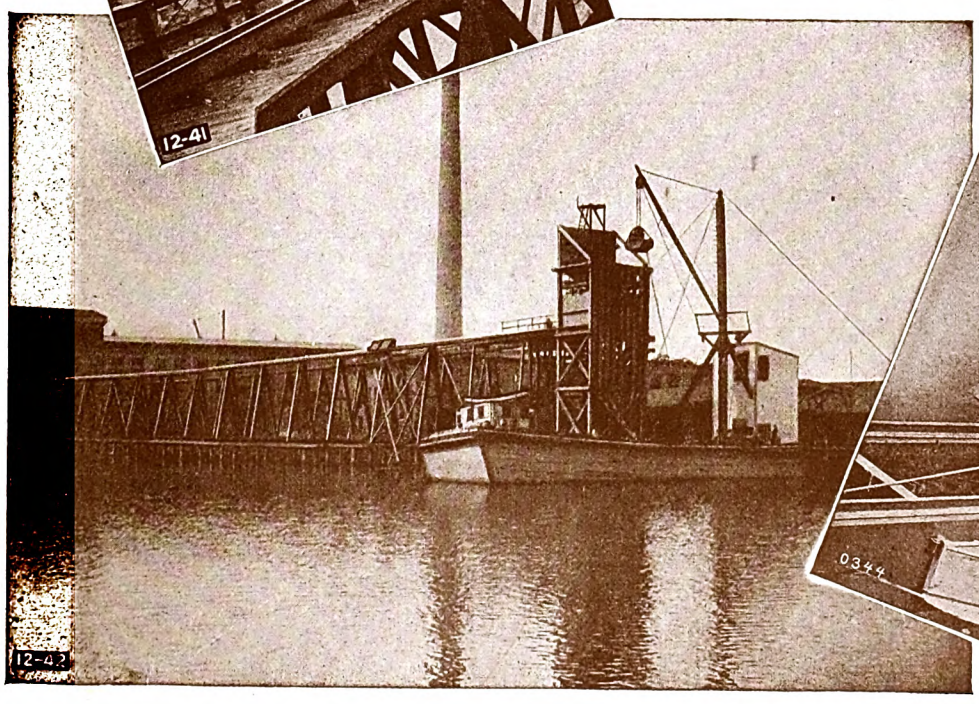
C. W. HUNT COMPANY, Inc.,

WEST NEW BRIGHTON, NEW YORK CITY

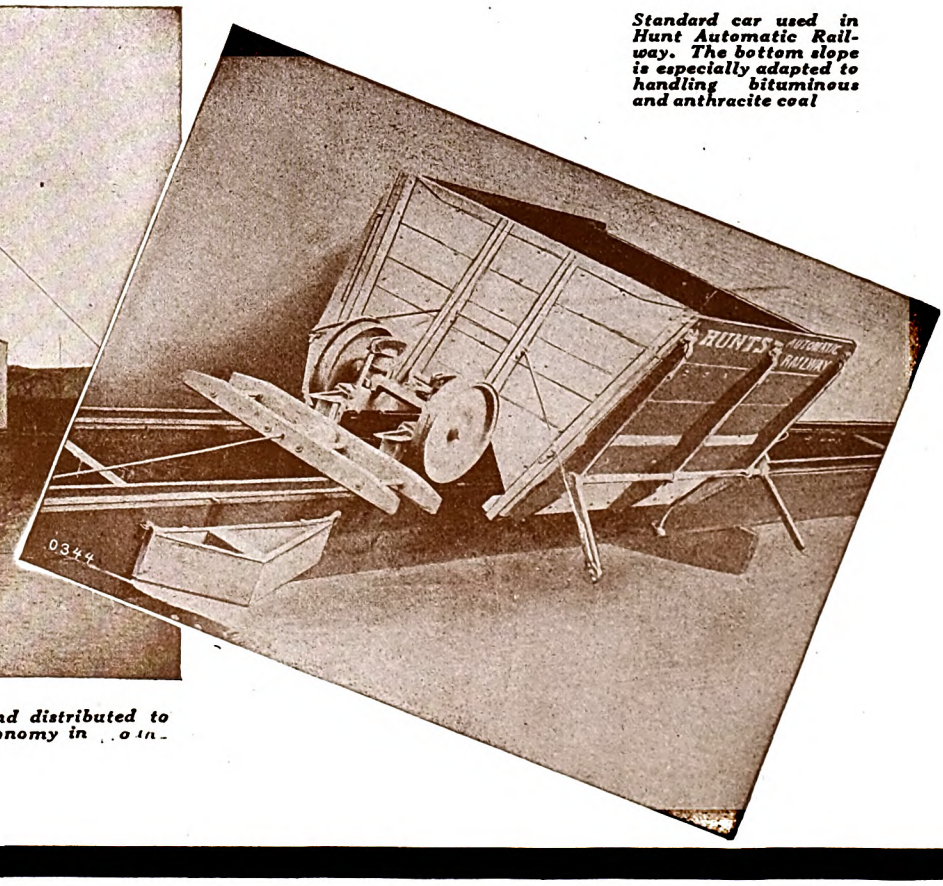
New York Office, Whitehall Building

Phillips, Lang & Co., Inc.
431 So. Dearborn St.,
Chicago, Illinois.

Ernest F. Learned,
141 Milk Street,
Boston 9, Mass.

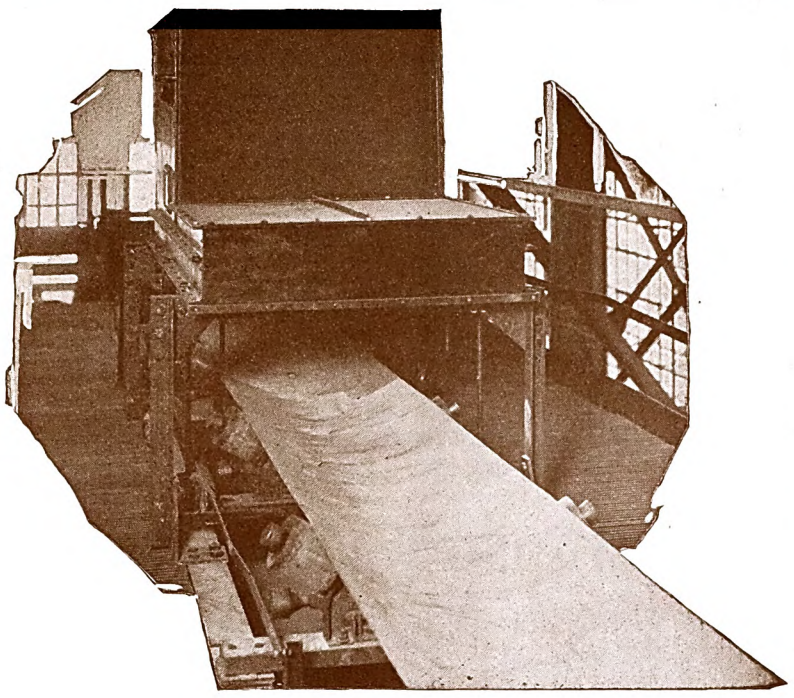


Coal received by water, is hoisted by a grab bucket on a Hunt mast and gaff and distributed to storage under the trestles of Two Hunt Automatic Railways. The utmost economy in ground space is thus secured



Standard car used in Hunt Automatic Railway. The bottom slope is especially adapted to handling bituminous and anthracite coal

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Do You Pay for Material You do Not Receive?

Thousands of dollars may be lost if there is no accurate check on your receipts. Bill of Lading weights are not always correct.

Hundreds of concerns now accurately check all conveyor handled materials bought and sold with the

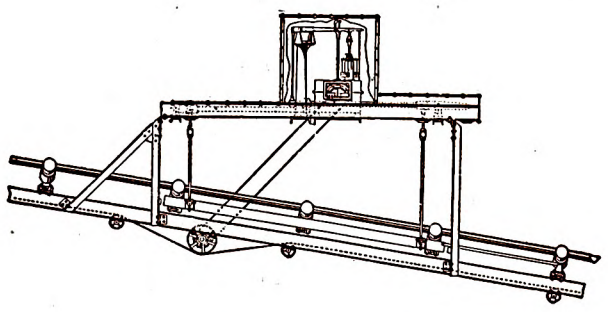
MERRICK
Conveyor Weightometer

The Merrick weightometer records the weights of materials automatically, as they are carried along on the conveyor. No interruption—no weighman required—*accuracy guaranteed 99%.*

The weightometer shows exactly the amount of materials handled and gives a check on production. It saves time and labor and is a profit-making investment.

Let us tell you more about the Merrick Conveyor Weightometer. The "Merrick Circulars" explain in detail the many advantages.

Write for them now.



MERRICK SCALE MFG. CO.,
180 Autumn Street, PASSAIC,

GRAPHICS WILL TELL
This check list of supplies will help you

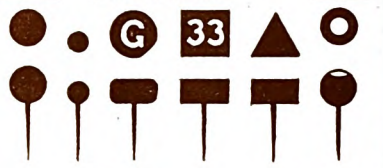
EDEXCO GRAPHIC RECORD SUPPLIES

EDEXCO MAP MARKERS



COLORED MAP PINS
NUMBERED MAP PINS
CELLULOID TACKS
MAP RINGS
MAP CORD
GLASS BEADS
GUMMED SYMBOLS
SIGNAL FLAGS
CARD SIGNALS



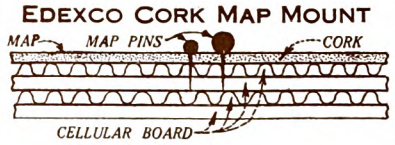


EDEXCO OUTLINE MAPS



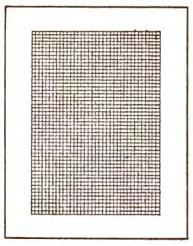
STATES
UNITED STATES
COUNTIES, R. R.'S, CITIES OF 25M
WORLD

EDEXCO CORK MAP MOUNT



SWINGING LEAF FIXTURES

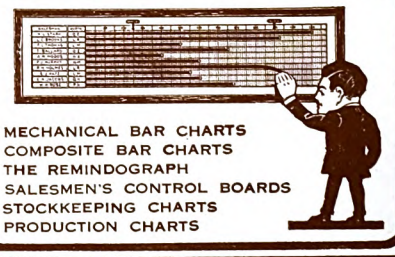
EDEXCO CHARTING PAPERS



LARGE SIZE
LETTER SHEET SIZE
LOGARITHMIC
ARITHILOG, SEMI-LOG
YEARBYDAYS
BARGRAPH
POCKET SIZE
COLORED CRAYONS

BOOKS ON GRAPHICS

EDEXCO MECHANICAL GRAPHS



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EDUCATIONAL EXHIBITION COMPANY
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(*Continued from page 70*)

lution of the question. One of the determining factors in this case was the ease of handling the fuel. In the estimation of the plant engineer, the equipment has more than measured up to their expectations. No smoke or ash is discharged from the stack, even when operating at 125 per cent. of rated capacity.

But that is not all. In view of the material reduction in the labor cost of handling its coal from the railroad cars to the boiler room and other parts of the plant using coal, this company has decided to equip all its furnaces and core ovens with powdered coal burners.

During the six months and more that this plant has been in operation there has been no destructive effect on the tubes from excessive heat, although slight trouble was experienced with the furnace lining. It is expected that this trouble will be remedied by the use of the proper high-temperature brick.

The use of powdered coal in boiler furnaces has not yet reached the same high level of development that may be claimed for stokers. Great credit, however, is due to those manufacturers, engineers and users, whose ideas have contributed to the many improvements, which have made these systems rivals of, and in many cases superior to, other methods of firing. The rapid progress has seen the successful solution of nearly all the major problems involved in daily continuous operation. A few minor problems remain, which are receiving consideration today, with a view to developing powdered fuel systems to an unusually high plane of economy and efficiency not possible with other systems.

Painting the Factory

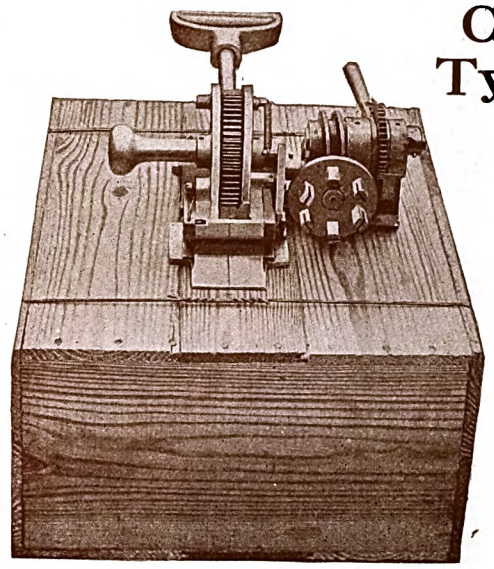
(*Continued from page 16*)

ing of factory interiors than ever before. Here, good painting of walls and ceilings makes cleaner, brighter more sanitary work places. When properly done and in such a tint as to diffuse daylight and artificial light to the greatest degree possible, it reduces the risk of accident, makes more cheerful surroundings for employees, lessens their eye strain and results in increased output. Men and women appreciate the advantages of clean, well-lighted shops. It raises their morale and they do more and better work in such places than in a factory where the rooms are unevenly illuminated, with dust and soot sticking to the walls and giving a gloomy aspect that communicates itself to the workers themselves.

The commonest method of applying paint is with a brush. The rising cost of hand labor, however, makes this an expensive process where any large amount of painting is to be done. By making use of the principle utilized in an ordinary atomizer, there is available a type of apparatus, now very widely used that will accomplish about eight times as much work in a day as can be done by one man with a brush. This is the spraying process. It is also called the air brush and the paint gun method. Compressed air, supplied from a portable, motor-driven compressor, or from an outlet from a main in buildings equipped with a compressed air system is used to force paint out of a container and through a hose leading to a nozzle from which the paint is ejected in a spray and thereby directed to any spot desired. The painter has both air and paint supply directly under control, can start or stop the spray at will and apply exactly the needed quantity to the surface in the quickest and most economical manner. Some of the illustrations accompanying this article show the use of paint spraying apparatus, including the use of an extension pipe attached to the end of the air and paint hose to enable a man to reach surfaces far above his head and thus usually avoid the use of scaffolding or ladders. Incidentally, this lessens the hazard of a type of accident very common in painting work.

It is stated that one coat of paint applied by a good spray-

(*Continued on page 77*)



CARY'S Seal Tying Machine

The sturdiest and most efficient machine ever devised for the application of wire bands at any desired tension to all kinds of boxes, crates, etc.

Simple but Positive

in operation. Fool-proof and built to stand hard service. Weighs only 14 pounds.

The manner in which the wire is automatically sealed insures maximum strength and leaves no sharp ends to protrude and cause damage.

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The wire with the patented shoulder

The Only Perfect Wire for Use in any Wire Tying Machine

A special drawn round galvanized wire in 13 and 14 gauge. The 13 gauge wire is packed in bundles containing 250 pieces; 14 gauge, 400 pieces in a bundle. Furnished in any length desired.

The patented shoulder holds the wire securely in any tying machine and absolutely prevents slipping. This is an exclusive feature.

Our method of bundling insures every wire being in perfect condition when received by you.

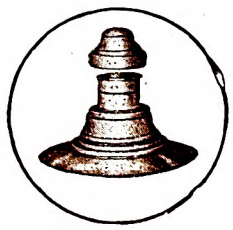
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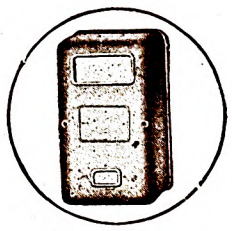
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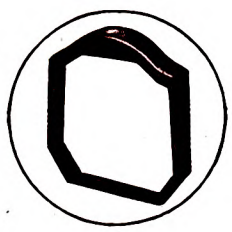


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This is not a mere statement but is based on performance records.



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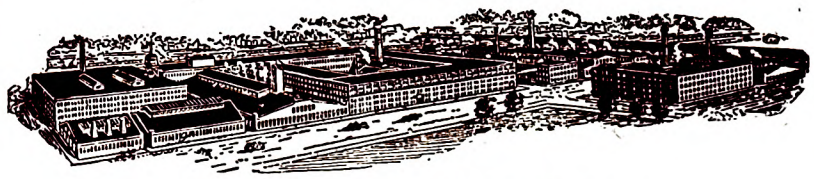
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If you were to get out from behind your desk and try out one of the Lay Metal Case Brooms, you would notice immediately the even balance, the wide sweeping tip—2" wider than all other industrial brooms—and the live resiliency of the fibre. These qualities in Lay brooms make for quicker, more efficient work from your sweepers.

Pioneers in the industry—three generations of broom builders—forty-four years of construction experience stand behind the adoption of Lay brooms by 90% of the steel industries, 40% of the railroads and more than 4,000 industrial plants. It is the Strength, Durability and Economy—the hidden qualities in broom construction—that have built up this wide demand for Lay Metal Case Brooms. This record and the constant inspection of each broom in the course of manufacture gives The Lay Company confidence in putting its unqualified guarantee on every one of its products. Our brooms make good, or we will.



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RIDGEVILLE INDIANA



No. 256-144 Steel wire Push Broom | No. 412 Bench Brush | No. 28-H Bassine Whisk | No. 253-165 Bass Push Broom | No. 3-W Steel wire Casting Brush

BYERS PIPE

GENUINE WROUGHT IRON



Illinois State Memorial Building, Springfield, Ill. Byers pipe used for plumbing and heating systems.

Municipal Court Building, Des Moines, Iowa. Byers pipe used for plumbing. Architects: Keffer and Jones, Des Moines, Iowa. Plumbing Contractors: Van Dyke Heating & Plumbing Company.

A Sixty-Year Record

THE durability of pipe used for steam, water, gas and air lines, is predicated on its resistance to corrosive attack. In plumbing, heating, sprinkler, refrigeration and power systems, even a small amount of daily corrosion in the course of a few years may destroy the most elaborate pipe system.

That Byers pipe installed upwards of 30, 40 and 50 years ago is still found intact in many of our older buildings, practically unharmed by corrosion, proves the rust resistance of the metal from which it has been made uninterruptedly since Civil War days.

With such a record, it is not strange that Byers pipe should be first choice for home, business and public buildings alike.

Whether the comparison is with cheaper or more expensive pipe, the economy of Byers pipe for most purposes is a matter easily demonstrated by consulting its service record, (See Byers bulletins Nos. 26-A, 27, 30, 32 and 34—free on request.)

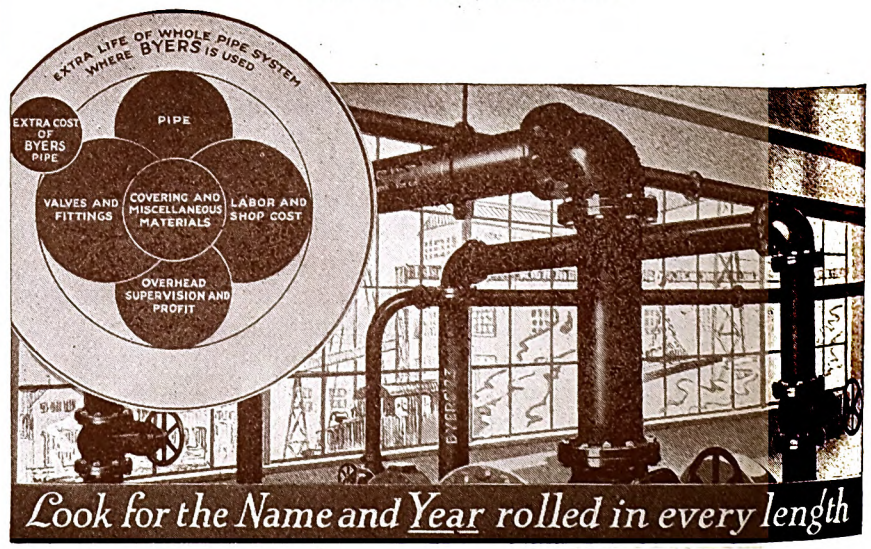
Based on installation cost, the extra cost of Byers pipe is trifling. See diagram. Ask for Bulletin No. 38 "The Installation Cost of Pipe."

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Established 1864

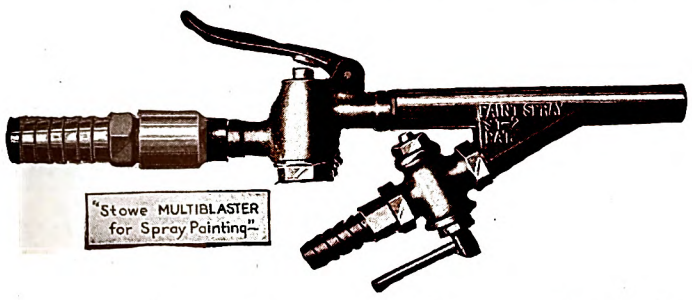
NEW YORK PHILADELPHIA BOSTON CHICAGO CLEVELAND HOUSTON

Distributors in all Jobbing Centers



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Put the MULTIBLASTER to work on your next Cleaning and Painting Job



Economy in Labor—Time—Materials

A STOWE MULTIBLASTER outfit for sand blasting and painting will replace 6 hand workers on metal surfaces and 18 to 30 men on concrete or wooden surfaces. It does the job better, gives more uniform distribution of paint and eliminates waste.

With the MULTIBLASTER one man can thoroughly cover an area of 3,000 sq. ft. per hour ***with one coat.*** This would require six men by the brush method and three coats of paint instead of one.

The simplicity of design and rugged construction of the MULTIBLASTER has led prominent manufacturers to equip their portable compressed air units with our Sand Blast and Paint Spray devices



"The Man Behind the Gun"
(COPYRIGHTED)



10 Day Trial Offer

We are willing to have you prove in your own plant just what the MULTIBLASTER can do in saving time, money and labor, just as it is doing in scores of industries, wherever painting and cleaning surfaces or machinery is required. Send for a MULTIBLASTER for 10 days free trial and pay for it only after you are convinced of its merits.

Pick out the one most applicable to your requirements from the list below, and send in your order to-day. If a fair trial does not prove satisfactory return it—we'll stand the expense.

Any outfit shipped by parcels post or express for 10 days' trial; ready for instant attachment to your air-lines.

They require no tanks. The sand is syphoned direct from pit, barrel or the pile (from canvas trough or jacket when cleaning high structures) and the paint from any convenient container.

List of Prices

	Price	Wgt. Lbs.	Hose Suction Inch	Pressure Lbs.
Standard Size Sand Blast	$30.00	8	1	80-90
Medium Size Sand Blast	18.00	6	¾	60-70
Bench Blast	15.00	3	½	40-50
Paint Spray	12.00	2	½	40-50

Prove its value to you before you pay a dollar

George M. Stowe, Jr.
Manufacturer
68 Forest Ave., Buffalo, N. Y.

(*Continued from page 75*)

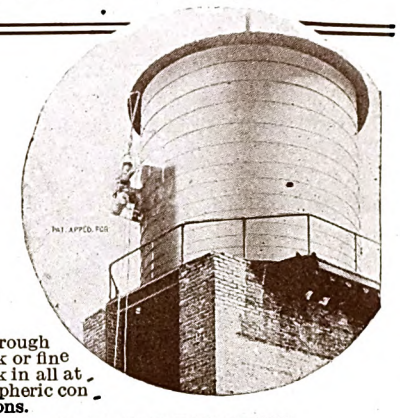
ing apparatus is equivalent in covering capacity to two coats put on with a brush. Conservative estimates by reliable manufacturers give the capabilities of the spray method as covering 500 square feet of surface per hour for satisfactory finish, dependent somewhat on the character and consistency of the paint. Of course there is a technique in the use of the air brush just as there is with the bristle brush. There is a certain distance, 6 or 8 inches from the surface, at which the nozzle should be held in order to produce the best results and use the minimum of paint applied in the proper thickness.

One man with a hand brush can apply from 2½ to 3 gallons of paint on 1,000 square feet of surface in an eight-hour day. Provided with a good spraying outfit he can put on from 15 to 20 gallons on 6,000 square feet in the same time.

Some comparative costs of painting with a brush and with the spray method are interesting and convincing. In general, painting contractors estimate that from 50 to 75 per cent. of the cost of any painting job is the labor cost. In a certain building, the cost of applying paint to the ceiling was $3.72 per 100 square feet using the hand brush. When spray painting was tried, the cost was $2.09 per 100 square feet. In wall painting, with a brush, for which it was necessary to use scaffolding, the cost of the job was $2.30 per 100 square feet; while with the spray, for which no scaffolding was used, the cost was only $1.34 per 100 square feet. It should be noted in this comparison that the cost of power and an allowance for depreciation were included in the determination of the cost of the spray method. Another comparison, derived from actual work, showed that to paint 280 square feet of surface required 3 hours, 10 minutes time, at $1.00 per hour hand-labor with a brush and $1.80 worth of paint. To cover this same surface by air brush painting used a little more paint (the cost of this being $2.00), but the job was done with the same labor in *twenty minutes!*

Exterior painting of a factory is, as has been stated, for the purpose of its preserva-

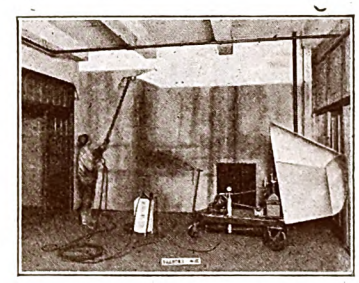
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Portable Painting Outfits



For rough work or fine work in all at mospheric con ditions.

PROPERTY MAINTENANCE At One-Sixth The Usual Labor Cost

One man operating Paasche air painting equipment does the work of a whole crew.



Used extensivey for daylighting factories.



For quickly Painting Everything Everywhere, with any kind of materials.

Always instantly Ready Dependable, Durable.

Portability itself an item of great economy.

The Paasche Air Brush
is a marvel of simplicity and efficiency. It has 12 Superior Features, including independent air and material supply. No clogging, no cleaning. Our catalog is ready for your careful study. Our salesmen-engineers are at your disposal.

Over 50,000 Paasche Air Devices in Daily Use.

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Inexpensively paraffining steel stock.

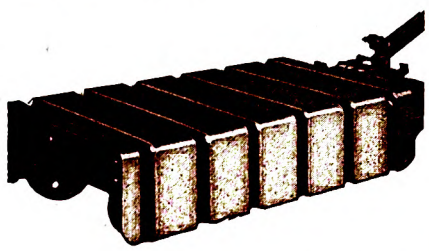
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TRUSCON ALLOY PLATFORMS STEEL



Steel Platforms Cut Cost of Handling and Conveying

Whether you use hand or power lift trucks, or a power hauling method, or an overhead conveyor system, or cranes, etc., you can save money through the use of Truscon Alloy Steel Platforms and Boxes.



Their sturdiness and scientific design ensures them long life without upkeep expense. Quantity production permits low prices. Made in numerous standard sizes and also to meet special requirements. Our extensive experience enables us to solve unusual problems.

Truscon Boxes for Steel Platforms

Skeleton boxes fitting any size platforms are furnished in various depths. They are either welded securely to the platform or equipped with steel stakes which slide into the ribs of the platform. Made of heavy gauge steel, reinforced with deep stiffening ribs and flanged edges. We make boxes to meet every requirement.

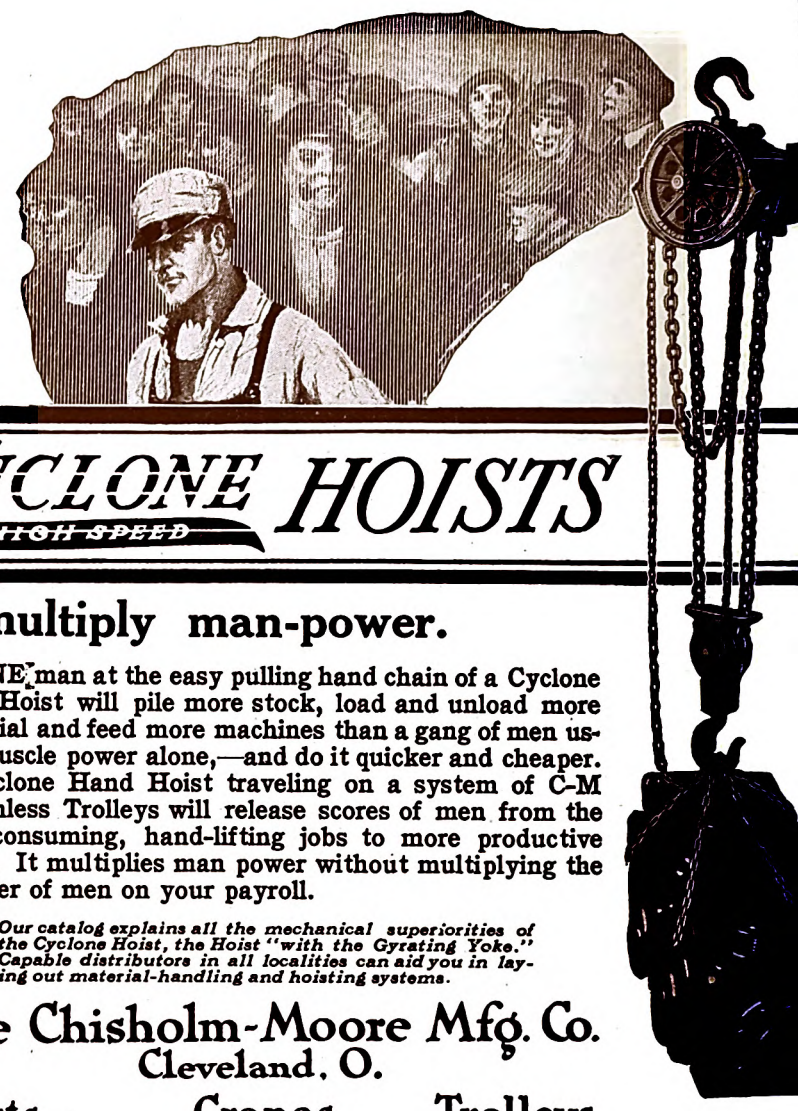
Tell Us Your Requirements for Anything in Pressed Steel Parts

Truscon Steel Company
YOUNGSTOWN, OHIO

Sales Offices in Principal Cities

tion; interior painting is concerned directly with production and with the health and morale of employees. Factory interiors are painted for the purpose of giving more light by diffusing daylight or artificial light more uniformly. It is usual to find factories under-illuminated and unevenly illuminated. This is just where good painting is such an asset to the plant. Walls and ceilings when painted white or in light colors are not only cleaner, more cheerful looking places, but the light tones scatter and diffuse the light more than do dark or dirty surfaces. White painted walls and ceilings are equivalent to an increase in the window space, because they diffuse the light admitted by the windows. A dark or dirty wall, on the other hand, reflects no light; what diffusion is secured in such a place comes from reflection from other objects like benches, machinery, etc.

White is commonly agreed upon as preferable to light colors for interior factory painting. There are special cases where some light color tints have been found best adapted to the work to be done, but they are exceptional. There is a difference of opinion, however, concerning the kind of surface a white paint for factory interiors should possess. By adding certain materials having the properties of varnishes, a shiny, glossy surface may be secured on a wall when the paint is dry. This looks well and is easy to clean; but possesses the disadvantage that it reflects more or less light directly. When light from an electric light bulk, or sky light from a window is reflected from this kind of surface, an objectionable glare is the result. There are too many "high lights." That sort of illumination is considered by eye specialists and illuminating engineers to be injurious to eyesight, especially for persons who are exposed to it throughout their working hours. In contrast to this gloss finish white, there is what is known as a "flat" finish, with no lustre; what most persons would call "dead white." This diffuses the light very well when first applied. Illumination measurements show that it reflects about the same proportion of the light striking it as



CYCLONE HIGH SPEED HOISTS

—multiply man-power.

ONE man at the easy pulling hand chain of a Cyclone Hoist will pile more stock, load and unload more material and feed more machines than a gang of men using muscle power alone,—and do it quicker and cheaper. A Cyclone Hand Hoist traveling on a system of C-M Matchless Trolleys will release scores of men from the time-consuming, hand-lifting jobs to more productive labor. It multiplies man power without multiplying the number of men on your payroll.

Our catalog explains all the mechanical superiorities of the Cyclone Hoist, the Hoist "with the Gyrating Yoke." Capable distributors in all localities can aid you in laying out material-handling and hoisting systems.

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Hoists Cranes Trolleys

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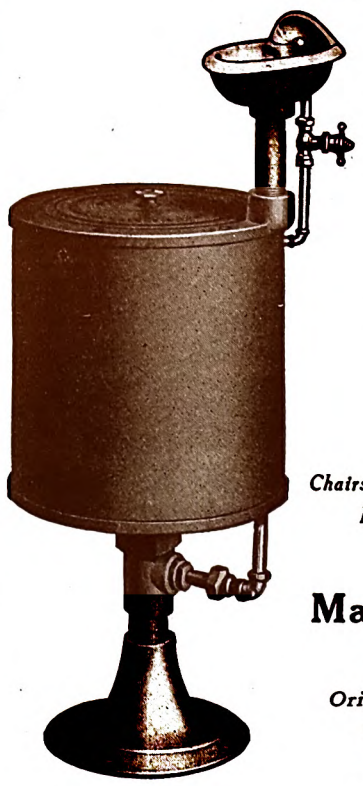
MEECO SANITARY DRINKING FOUNTAINS

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Practical, Tangible Assets in the Modern Factory

We guarantee their durability and efficiency.

Let us send you proof of their economy in both first cost and operation.



Chairs and Stools Lockers METAL MEECO PRODUCTS *Sanitary Washbowls Shelving*

Manufacturing Equipment & Engineering Co.

Originators and World's Largest Makers of Ice-Cooled Drinking Fountains

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MEECO COOLERS

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does a gloss surface. But the flat finish soon becomes darker by reason of particles of dust and soot that adhere to it. And once adhering to such a surface, they are very difficult to clean off—practically impossible, in fact.

Either of these extremes is undesirable. Without discussing the relative merits of the substances used in factory paints, the prevailing practice approves the use of a paint with the whitest materials obtainable as a base, combined with enough of the proper glossy liquid to give a smooth, slightly glossy surface; one in which the minute particles constituting the white body of the paint are barely covered, yet not so directly exposed as to form a roughened surface. This gives the maximum of light diffusion, does not readily collect dirt or soot and can easily be cleaned. It must also be composed of materials that do not readily react with the vapors of sulphur, ammonia, and the like. There are many lines of manufacture such as textiles, dyes, rubber, paper, packing, etc., that for this reason make the permanence of the whiteness of painted walls and ceilings a matter for serious study.

There are many parts of the structure of a factory that require special kinds of paint. For example, structural steel work is always painted before shipment from the rolling mill to protect it from rust and corrosion. In one of our illustrations a man is shown applying a special kind of paint to the steel frame of a building for the purpose of preventing corrosion of the steel which often occurs after it has been enclosed in concrete, stone or tile work; an occurrence particularly dangerous because it is hidden. Roof painting calls for a special class of paints because of the peculiar conditions of exposure to extremes of temperature and moisture as well as a consideration of the fire hazard.

There is also a kind of paint that can be applied to wooden structures in order to waterproof them and prevent decay. Timbers such as sills and posts are frequently so painted where the expense of the more usual preservative treatment is not considered warranted. For instance, the sills of a wooden building can be brushed over at small expense with a paint made from certain grades of coal tar oil and their useful life considerably lengthened. Coal trestles, water tank supports, coke and sand bins, etc., are well adapted to such preservative painting.

Concrete floors sometimes give trouble in a factory, and in this case also, painting proves itself a worth-while expense by maintaining a hard, smooth surface that does not become dusty and that presents a good color contrast with walls and ceilings. Paint especially adapted to the treatment of concrete floors can be obtained in several colors and made of materials designed to withstand the wear and tear to which factory floors are subjected.

For painting the outdoor structures that are necessary at most large manufacturing plants, it has been usual to employ, particularly on steel work, a good grade of weatherproof paint. This kind of paint, usually having a graphite or

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Buy Daylight and reduce maintenance costs to a minimum.

Conservation of waste, means to utilize what nature gives you, and not to permit anything which can be used, to be thrown away.

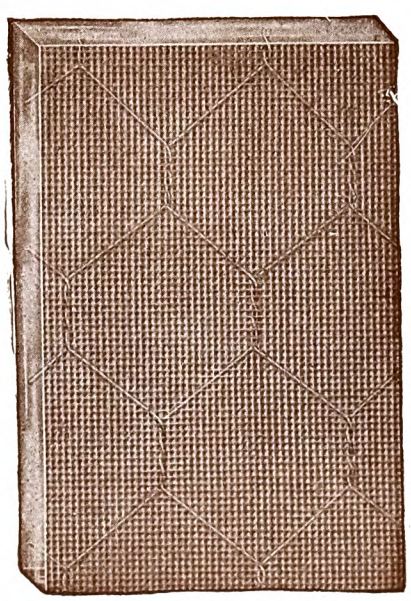
Daylight is the cheapest commodity you have. Utilize it and conserve artificial energy until daylight is gone.

The United States Government has used nearly 200,000 square feet of FACTROLITE in one building alone and many thousand square feet in others.

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Daylight inside the building and no shadows. Total light transmitted through FACTROLITE 84.5 per cent. FACTROLITE is made in plain and Wire Glass.

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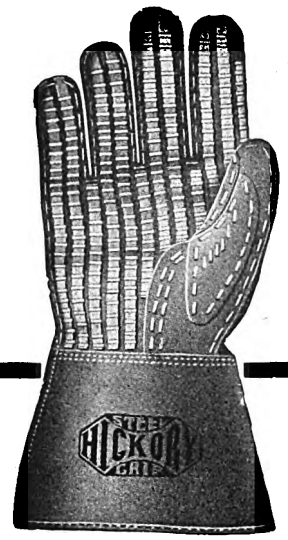
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Mississippi Wire Glass Co., 219 Fifth Ave., New York.
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No. 644 Gauntlet Glove, reinforced with flexible steel ribbons clinched over strips of tough leather. Extra leather patch on the thumb
$18.00 in dozen per lots

STOP

Lost Time from Torn Bruised Hands

Here are gloves made expressly for industrial use—for men who handle castings and other rough materials.

STEEL-GRIP GLOVES

are made up of three thicknesses of wearing surfaces and a comfortable lining—flexible steel ribbon re-inforcement clinched over tough strips of leather. They can't come loose nor hurt the hand. All gloves stitched with strong steel thread—no danger of seams ripping, burning nor tearing out.

STEEL-GRIPS save the frequent trips to the store-room for "another pair of gloves." You aid the men and increase production by furnishing them with STEEL-GRIP GLOVES.

Send for a Catalog

Try a dozen pairs.

INDUSTRIAL GLOVES CORP.
201 Fuller ton Ave., Chicago



No. 605 Short Gloves steel ribbon reinforcement and extra wearing patch in palm. $16 in dozen pr. lots

STEEL GRIP
MADE IN CHICAGO

bituminous base, is applied after a priming coat of red lead. The steel work of outdoor switching stations at factories that receive their supply of electric energy from an outside source has very frequently been protected by galvanizing the steel. So much difference in practice in this respect was noticed that recently a questionnaire was sent out by the "Electrical World" to all parts of the United States. The answers showed that for outdoor structures on electric transmission lines, both painting and galvanizing were about equally relied upon. In some localities the zinc coating afforded better protection than that of the best paint. In other cases the reverse was true. The question resolves itself into a determination in each case of the kind of impurities present in the air, such as locomotive smoke, acid fumes, etc., that would cause a chemical action whatever material was used for a protective covering on the steel structure.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of INDUSTRY ILLUSTRATED published monthly at Cooperstown, N. Y., for April, 1923. State of New York, County of Otsego, ss.

Before me appeared John H. VanDeventer, who having been duly sworn according to law, deposes and says that he is the President of the Industry Illustrated and the following is, to the best of his knowledge and belief a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Engineering Magazine Co.; Editor, John H. VanDeventer; Managing Editor, John H. VanDeventer; Cooperstown N. Y.

2. That the owners and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock are: Engineering Magazine Co.; John R. Dunlap; J. R. Dunlap, Jr.; John H. VanDeventer; Harvey Conover, Jr. All addresses same as publication office.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JOHN H. VANDEVENTER.

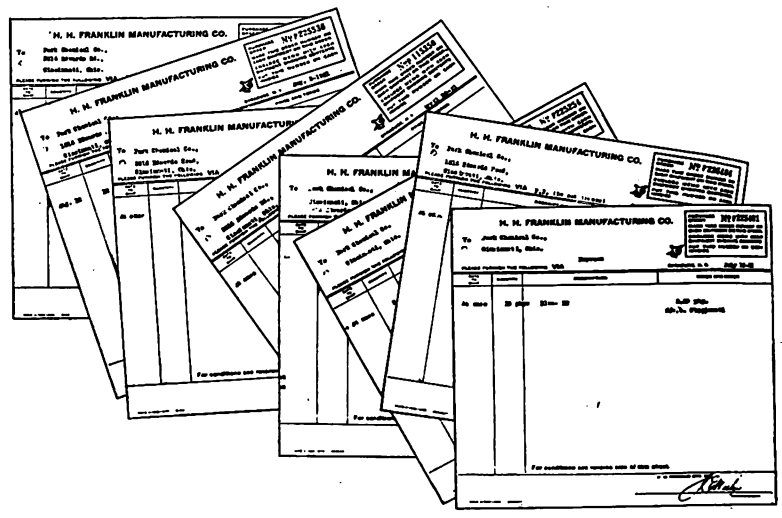
Sworn to and subscribed before me this 26th day of March 1923.

Ralph E. Finch.
(My commission expires March 1925.)

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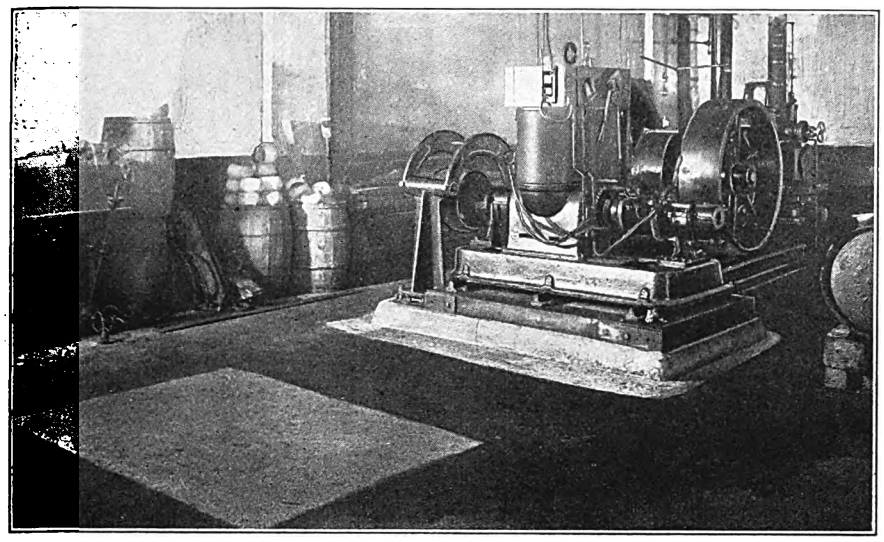
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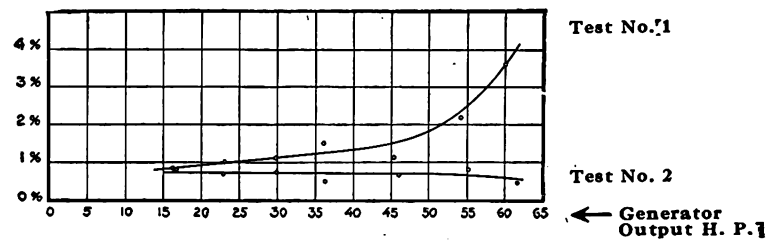
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WHERE THE TEST WAS MADE



¶ Saving of belt slip 86% at 60 H. P. generator outdut OPEN DRIVE with canvas laggings on pulleys

Belt Slippage Reduced 86%

Two tests were made on the generator drive shown above. The results are shown on the accompanying chart.

The No. 1 test was with an open drive with canvas laggings on pulleys. In test No. 2 the Lenix drive was employed.

The results may surprise those who are not familiar with the Lenix It will be noted that as the H. P. advanced the Lenix not only prevented additional slippage but ***actually reduced it.*** At 60 H. P. the saving of belt slippage was 86%.

Yet this is only one of the savings effected by the Lenix. The "Five Points" at the left mention others.

If power or floor space mean anything to you—if a steady drive means anything—you will want to get the whole story about the Lenix. A post card will bring our booklet, "Saving Slippage and Space."

Five Points

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains, constantly and accurately the proper tension in the sack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors orgenerators because of the higher pulley ratios.

F. L. SMIDTH & COMPANY
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50 Church Street, New York

The LENIX Drive

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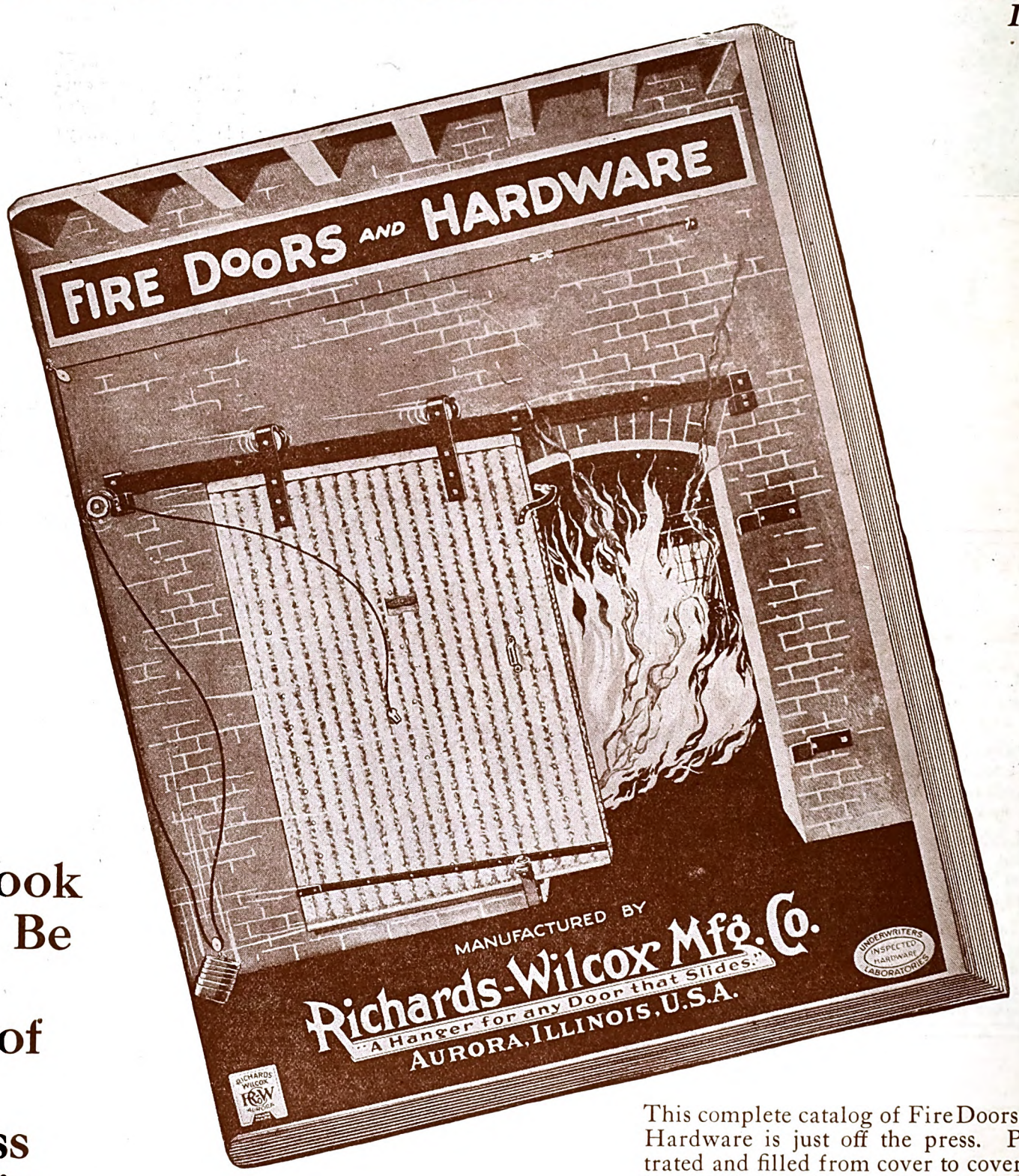
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